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THE ALUMINUM WORLD: COPPER AND BRASS: THE BRASS FOUNDER AND FINISHER
ELECTRO-PLATERS REVIEW

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Annual Meeting of the Institute of Metals Division

A Report of the Sessions Held in New York, February 15-18, 1926

The Institute of Metals Division of the A. I. M. E. held its winter meeting from February 15-18, 1926, inclusive, at the Engineering Societies Building, 29 West 39th street, New York. Four sessions were devoted to metals, and an unusually strong program was offered.

At the dinner of the Institute, which was, as usual, very well attended, Secretary Corse reported that the Institute now included 617 active members and that the finances were in excellent condition. The lecturer for 1927 will be Dr. C. H. Desch of England.

New officers were elected for the next two years. These officers are as follows:

Chairman: Dr. P. D. Merica, International Nickel Company, New York.

Vice-Chairman: Dr. Zay Jeffries, Cleveland, Ohio.

Secretary-Treasurer: W. M. Corse, Washington, D. C.

Executive Committee: W. K. Frank, H. C. Jennison, R. L. Suhl, R. F. Wood, R. J. Anderson, D. Levinger, S. Skowronski, L. W. Spring, J. R. Freeman, Jr., P. McKinney.

After the business session, the members were addressed by Hugh Farrell, the associate editor of the New York Commercial, and the author of "What Price Progress?" Mr. Farrell, who is working with the Chemical Foundation, spoke on the need for stimulating research, both fundamental and practical, in the United States to prepare this country for competition from abroad.

Walter Warwick, an attorney of Cincinnati, Ohio, formerly comptroller of United States Treasury, and financial advisor to the Republic of Panama, spoke on his experiences in government work in the United States and abroad.

EFFECT OF REHEATING ON THE Al-Cu-Ni-Mg AND THE Al-Cu-Fe-Mg (PISTON) ALLOYS

By Samuel Daniels, Dayton, Ohio

The Al-Cu-Ni-Mg alloy is much benefited by heat treatment and, in such condition, is preferable to the Al-Cu-Fe-Mg alloy either as cast or as heat-treated, when both are reheated to temperatures of from 400° to 600° F. and and compared, cold, with respect to strength and to hardness. The main differences between the alloys do not arise until the reheating temperature exceeds 400° F., above which they gradually soften. This softening is characterized metallographically by the appearance of intragranular precipitate. The Al-Cu-Ni-Mg alloy is weakest and least hard after being reheated at 600° F., the Al-Cu-Fe-Mg alloy at about 700° F. The former starts to reharden at 700° F., the latter at 800° F. There is a tendency for both alloys to lose strength and hardness with prolongation of time at the reheating temperatures of 500° and of 700° F. The Al-Cu-Ni-Mg alloy is considerably stronger and harder than the Al-Cu-Fe-Mg alloy when both are heat-treated and reheated for long periods of time at 500° and 700° F. Although the latter can be made harder initially than the Al-Cu-Ni-Mg alloy by suitable quenching and aging, heat treatment, in general, favors the retention of this initial (strength and) hardness after reheating to a much greater degree in the Al-Cu-Ni-Mg alloy. The percentage of elongation of the two materials in any condition is very small.

ENDURANCE PROPERTIES OF NON-FERROUS METALS

By D. J. McAdam, Jr., Annapolis, Md.

This paper presents stress-cycle graphs for five samples of monel metal and three high-strength aluminum alloys. These graphs are evidently curves with horizontal asymptote. The position of the horizontal asmpytote can be determined with sufficient accuracy by extending the experiments to not more than 50,000,000 cycles. For some of the graphs, there is a slight downward slope between 50,000,000 and 100,000,000 cycles. The slope is so slight, however, that extrapolation from 50,000,000 to 100,000,000 cycles gives the endurance limit with sufficient accuracy. Monel metal and duralumin are not exceptional among non-ferrous metals in endurance properties.

THE LEAD-ANTIMONY SYSTEM AND HARDENING OF LEAD ALLOYS

By R. S. Dean, Lyall Zickrick and F. C. Nix, Chicago, Ill.

In previous papers the solid solubility of antimony in lead has been shown to vary from 2.45 per cent at the

eutectic temperature to less than 0.8 per cent at room temperature. The discovery of a marked age-hardening phenomenon in lead-antimony alloys has also been reported and its connection with this solubility change discussed. It was also pointed out that the solid solutions below 1 per cent were quite stable and broke down very slowly, making it difficult to determine the actual solubility at room temperature.

In the present paper evidence has been presented which shows that:

1. The solid solubility of antimony in lead at room temperature is at least as low as 0.5 per cent and probably not far from this figure.

2. The evidence which has been put forward for the existence of a compound in the lead-antimony is capable of other interpretation.

3. The lead-antimony alloys of approximately eutectic composition behave normally with regard to volume change on solidification.

4. Age hardening may be observed in all lead-antimony alloys containing more than 0.5 per cent antimony.

6. The rate and degree of age hardening is determined by the rate of cooling.

7. An equilibrium value for the strength of the alloy is reached at any given temperature. This value depends on the temperature and previous treatment of the alloy.

A PRELIMINARY STUDY OF MAGNESIUM-BASE ALLOYS

By Bradley Stoughton and M. Miyake, Bethlehem, Pa.

From a practical standpoint, the most promising of the magnesium-base alloys are magnesium-aluminum and magnesium-zinc as binary alloys and magnesium-zinc-aluminum as ternary alloys.

Aluminum appears the most favorable alloying metal for magnesium, both on account of its low density and its nearness to magnesium in the electro-chemical series. The mechanical properties of these alloys were fully investigated by the Dow Chemical Co. and jointly by the Aluminum Co. of America and the American Magnesium Co. These are shown graphically. These alloys not only possess excellent mechanical properties, but have a remarkably low density even in the 12 per cent aluminum alloy. Physical and mechanical properties of the 3 per cent aluminum alloy are given in a table.

The magnesium alloys containing 4 per cent or more aluminum can be improved in mechanical properties by a suitable heat treatment. Such treatment not only increases the strength of the alloy, but shifts the position of the maximum tensile strength toward higher aluminum alloys. According to the Aluminum Co. of America and the American Magnesium Corp., if the alloy, either worked or cast, is cooled rapidly after this heat treatment and is reheated to a temperature of from 150° to 250° C. for a number of hours, the magnesium-aluminum compound precipitates out of solid solution in very small particles and causes hardening.

These resemble those of the magnesium-aluminum alloys. Tensile strength and specific gravity are shown in a table for varying percentages of zinc. "Electron," made by the Chemische Fabrik Griesheim-Elekron, Frankfurt, Germany, is practically a series of magnesium-zinc alloys. It can be extruded, rolled, or drawn at 400° C. and forged at 200° to 250° C. Cold working causes brittleness, but the ductility is recovered on annealing.

Their mechanical properties may be improved by a suitable heat treatment as with the magnesium-aluminum alloys. The magnesium-zinc alloys may be hardened materially by quenching from a temperature somewhat below the solidus, followed by reheating to a temperature higher than room temperatures. An enormous increase in hardness is obtained by heating some of these alloys for 2 hr. at 340° C., quenching in water, and then reheating for 4 hr. at 150° C. This effect is especially great in high-zinc and chill-cast alloys. By the proper selection of temperature and time, excellent results may be expected.

EQUILIBRIUM RELATIONS IN ALUMINUM-COPPER ALLOYS OF HIGH PURITY

By E. H. Dix, Jr., and H. H. Richardson, New Kensington, Pa.

This work comprises the re-checking of the aluminum-$CuAl_2$ eutectic temperature and concentration, and the locating of the solidus curve as well as the microscopic determination of the solid solubility of copper in aluminum from eutectic temperature to 200° C., using aluminum alloys of the highest purity obtainable. This was in order to establish these phenomena with the new high purity metals developed by the Aluminum Co. of America as against the comparatively contaminated metals used by previous investigators.

New Officers of the Institute of Metals Division

DR. PAUL D. MERICA
Chairman

DR. ZAY JEFFRIES
Vice-Chairman

W. M. CORSE
Secretary-Treasurer

The following points were investigated. Cooling curves; solid solubility; equilibrium diagram of the aluminum-copper system; solubility relations; structure of pure aluminum-copper alloy; hardness values; precipitation theory; slip interference theory; effect of impurities in aluminum.

MODIFICATION AND PROPERTIES OF SAND-CAST ALUMINUM-SILICON ALLOYS

By Robert S. Archer and L. W. Kempf, Cleveland, Ohio

Results are given of an investigation of the effects of silicon content and iron content on the tensile properties of sand-cast aluminum-silicon alloys modified by the addition of sodium to the melt shortly before casting. The modifying process is discussed in detail and some suggestions are made for the practical operation of this process. The tensile properties are also given for a series of normal sand-cast aluminum-silicon alloys.

The more important results are summarized in the following statements. The values given for the strength and elongation of the modified alloys are not average values but nearly maximum values of well modified sand-cast test bars ½ in. in diameter. The alloys under consideration contain less that 0.05 per cent each of copper and manganese.

1. Metallic sodium produces as good and as uniform modification as the salt flux, and is distinctly more economical.

2. The chief requirement for good modification is that the molten alloy contain a certain refinite amount of sodium at the moment of casting. Larger or smaller amounts give inferior results.

3. The amount of sodium required for modification varies with the silicon content, and perhaps with other characteristics, of the alloy to be modified. The amount of sodium added to produce good modificatin, under the specific conditions here employed, varies from about 0.01 per cent for an alloy containing less than 1 per cent silicon to about 0.10 per cent for an alloy containing 14 per cent silicon.

4. For sand castings ½-in. thick modified with sodium, the modified "eutectic" occurs at about 14.0 per cent silicon.

5. The tensile strength of the normal alloys increases with silicon content from 12,800 lb. per sq. in. for the aluminum ingot used to about 22,000 lb. per sq. in. at the composition of the normal eutectic (11 to 12 per cent silicon), and then decreases rapidly with further additions of silicon. This applies to alloys containing 0.35 per cent iron.

6. The elongation of the normal alloys decreases rapidly from 25 per cent for the ingot to 10 per cent at about 2 per cent silicon, then more slowly as the silicon increases. There is apparently a slight maximum of about 5 to 6 per cent elongation at the composition of the normal eutectic. Further additions of silicon cause the elongation to decrease rapidly to less than 2 per cent at 14 per cent silicon.

7. For all compositions both strength and elongation are improved by modification.

8. The tensile strength of the modified alloys (0.35 per cent iron) increases with silicon content to a maximum of 27,000 to 28,000 lb. per sq. in. at the composition of the modified eutectic (14 per cent silicon) then decreases with further additions of silicon.

9. The elongation of the modified alloys decreases from 28 per cent for the ingot to about 13 per cent at 1.5 per cent silicon, remains nearly constant to about 12 per cent silicon, rises slightly at the composition of the modified eutectic (14 per cent silicon), and then falls rapidly with higher amounts of silicon.

10. The addition of iron above 0.35 per cent to the modified alloys decreases elongation.

11. The addition of iron above 0.35 per cent to the modified alloys containing 11 to 14 per cent silicon increases tensile strength up to about 0.75 per cent iron; further addition of iron decreases tensile strength as well as elongation.

12. The alloy compositions which give the maximum properties when properly modified are not necessarily those which will consistently give the best average results in commercial practice.

DISCUSSION

Jesse L. Jones asked if great difficulty had been found in reaching Naval specifications in castings as large as 2,500 pounds.

Mr. Archer said that the main problem of reaching the standards set by the Naval specifications was in the modification process. In one casting, 900 lbs. in weight which was made by making a 900-lb. melt in a refractory lined furnace and using a 900-lb. pouring ladle, sodium was added in the pouring ladle six times while the metal was running from the furnace into the ladle. This was found necessary because the action of the sodium would be lost if it had been added in a much larger quantity all at once. He gave it as his opinion that a 2,500-lb. casting might be poured by some such method.

In answer to another question he stated that he did not use any other fluxes with sodium in melting clean aluminum-silicon alloys as he thought they would probably do more harm than good.

R. P. Heuer asked if aluminum separated out with the annealing of a modified casting. Mr. Archer answered that annealing resulted in spheroidizing the silicon particles resulting in a decreased tensile strength and increased elongation.

THE MICROSTRUCTURE OF ALUMINUM

By K. L. Meissner, Berlin, Germany

So-called pure aluminum contains noticeable amounts of impurities, chiefly iron and silicon. The solubility of $FeAl_3$ in solid aluminum is practically zero, or at least so small that the smallest trace of this compound is always visible as a separate constituent. A constituent of unknown composition produces a small thermal effect at 610° C. on the cooling curves of aluminum with small amounts of iron and silicon. It was thought to be a ternary compound containing iron and silicon and could be observed under the microscope as dark particles. An examination of unetched micrographs of an aluminum with 0.51 per cent iron, 0.99 per cent silicon, and 0.32 per cent copper, shows that an alloy of aluminum, iron, and silicon must contain the following four constituents: Al, $FeAl_3$, Si, and a compound of Fe and Si. This, however, does not agree with the laws of chemical equilibrium.

ANNUAL INSTITUTE OF METALS LECTURE

THE RELATION BETWEEN METALLURGY AND ATOMIC STRUCTURE

By Paul D. Foote, Washington, D. C.

It must be admitted that up to the present moment the theory of atomic structure has contributed little of a definite nature to our knowledge of the solid state. We

In this paper a method of research originated by Guertler and first applied by the author, for determining the equilibrium conditions in a number of ternary metal systems, is used in an effort to explain this problem.

have confined ourselves to a very superficial consideration of but two general types of phenomena, paramagnetism and crystal structure, hoping that some opening would appear for the powerful entering wedge of spectroscopy. The consideration of the vast accumulation of data on thermal and electrical conductivity, specific heats, thermoelectric and many other physical phenomena does not appear capable of yielding immediate results of a more definite character.

It is important that x-ray scattering experiments be developed at least to a stage where one may definitely conclude whether or not an atom exists as an ion in the metal. The observations on the photoelectric limit of metals are hopelessly discordant and almost no reliable data for the magneton numbers of the solid elements are available.

In spite of the difficulties enumerated one should recall that the development of the modern theory of atomic structure and spectroscopy has extended over a period of less than 15 years. The advances made in spectroscopy during the past two years have exceeded those in all preceding history. Our present knowledge of the solid state corresponds in many respects to the chaos in spectroscopy in 1912 before the introduction of the Bohr hypothesis. Undoubtedly, the next two decades will witness just as rapid development in the extension or adaptation of these ideas to the solid state. With this development will come applications of practical value to the metallurgist.

THE HARDNESS OF COPPER AND MEYER'S ANALYSIS

By Samuel L. Hoyt and T. R. Schermerhorn

The use of Meyer's analysis in hardness tests on two copper bars is described, showing the control afforded by Meyer's method. The variation of the resistance to penetration with varying loads is brought out in support of this method, over the usual Brinell method, in accurate work. The reversal in hardness during cold rolling, as noted by Rawdon and Mutchler, is discussed along with the application of Meyer's analysis to such a study. The "anvil" effect on the hardness numbers of thin samples may be quickly identified by this method by plotting the impression diameters against the loads on logarithm paper. It was found that the anvil effect leads to hardness numbers which are too low. The impression diameters were found to be markedly influenced by the time the load is maintained on the ball.

THE EFFECT OF LEAD AND TIN WITH OXYGEN ON THE CONDUCTIVITY AND DUCTILITY OF COPPER

By Norman B. Pilling and George P. Halliwell

1. Tin and lead may be present in copper of commercial purity without loss of either ductility or conductivity provided the sum of the lead and half the tin contents does not exceed the oxygen content. This may be regarded as the maximum tolerance, not to be approached in conservative practice.

2. When the above condition is observed, the tensile and electrical properties of copper containing lead and tin are directly related to the total oxygen content.

3. When the above condition as to oxygen content is not observed, an excess of tin depresses the conductivity and is without effect on the ductility; an excess of lead reduces the ductility without appreciable effect on the conductivity, and impairs the cold-rolling properties.

4. A careful comparison of wirebars produced under commercial conditions has shown that copper containing residual lead and tin up to 0.03 per cent total is fully the equal, both as to conductivity and ductility, of average grade electrolytic wirebars.

DISCUSSION

S. Skowronski claimed that in his experience .0075 per cent lead was enough to cause trouble by making sheets hot short. Conductivity is no proof of purity; copper with .15 per cent lead can have a conductivity of over 100. Lead probably counteracts arsenic and if the copper contains appreciable quantities of arsenic, the conductivity can be raised by adding lead, as is sometimes practiced in England.

W. H. Bassett stated that the limit of the lead content in copper is .005 per cent. More lead causes cracks in hot rolling sheet, in actual mill practice. Tin can be present up to 3 per cent for hot rolling, and for cold rolling, lead can be present up to 1 per cent. Mr. Bassett disagreed completely with the conclusion of No. 1, and disagreed with conclusions No. 3, in that excess lead impaired hot rolling and not cold rolling properties.

One of the members present stated that in his experience of ten years in making wire bar, he had found that the conclusions of the authors of this paper were correct. He had found that perfectly satisfactory wire bar could be made from copper with tin and lead present to the amounts mentioned and that no difficulty had been experienced with the wire drawn from these bars.

EXUDATIONS ON COPPER CASTINGS

By W. H. Bassett and J. C. Bradley, Waterbury

Beads of metal frequently appear at the ends of cast-copper wire bars and on the sides of wedge cakes near the top. These are richer in cuprous oxide than the rest of the casting. A micrographical study of these exudations has been made. It is suggested that the material is forced through the surface while the copper is solidifying. If not eliminated in process of manufacture, it shows on the finished polished sheet copper in patches differing in color from the main body of the sheet.

DISCUSSION

F. R. Pyne stated that these exudations shown occurred in cold spots of the mold; that is where the mold was too thin to hold the heat or where the coating of the mold had been rubbed off and the copper cooled too quickly at that point.

MICROSCOPIC STRUCTURE OF COPPER

By H. B. Pulsifer, Cleveland, Ohio

The following report on the structure of copper is the result of work done in the laboratory of the Rome Wire Co. early in 1925. Previous work had indicated to the author that excellent results might be expected if a suitable technique in surfacing and etching could be developed. The resources of the Rome Wire Co. enabled this metal to be studied more intensively than previously, although none of the materials were investigated exhaustively. The material presented is hardly more than a preliminary summary of the most obvious character of the metal; a much longer research would have been necessary to solve many of the pressing problems connected with the casting and working of copper.

The author showed photo-micrographs of copper up to as high as 1,500 diameters in various conditions, cast, hot rolled, cold worked, etc. He explained the methods of surfacing copper and the various etching reagents used.

EMBRITTLEMENT OF COPPER BY HOT REDUCING GASES

By T. S. Fuller, Schenectady, N. Y.

The purpose of this paper is to report several instances of copper embrittlement caused by hot reducing gases, which may be correctly termed "factory troubles."

Fully annealed copper that has been heated under non-reducing conditions shows "tight," sharply defined, grain boundaries and square corner grains of the cubic structure. When heated to a high temperature under severely reducing conditions, copper shows intergranular cracks and rounded grains in direct contrast.

Several cases are given of copper containing oxide being made brittle by the action of reducing gases. Rail bonds showed embrittlement when combustion of the furnace in which they were heated was so regulated that reducing conditions existed in the region they occupied. Calorized electric soldering copper, when heated at a high temperature in hydrogen, produced blisters and cracks on the surface of the soldering irons; the difficulty was overcome by using copper free from oxide. This same phenomenon was found to be the cause of very minute leaks in high-voltage X-ray tubes, the successful operation of which depends on keeping a very high vacuum, which can only be maintained by the use of absolutely non-porous materials in the construction of the tube. Similarly, the action of hot reducing gases causing brittle copper was found to be the cause of the difficulty that developed with the flexible leads used in the manufacture of pilotrons of 20-kw. capacity. An unexpected case of embrittlement occurred in fine copper wire during an enameling process, due to reducing conditions caused by the vapor of the enamel solvent and the decomposition of the enamel base.

ACTION OF REDUCING GASES ON HEATED COPPER

By W. H. Bassett and J. C. Bradley, Waterbury, Conn.

In considering the effects of reducing gases on hot solid copper the following conclusions have been reached. (1) Depth of deoxidation of copper heated in reducing gas is greater the smaller the amount of cuprous oxide originally present in the copper, the range studied being from 0.015 to 0.136 per cent oxygen. It is suggested that the reason for this difference in depth of deoxidation is that, when the copper is low in cuprous oxide, the reducing gas is diluted less by the gas that is formed in the reaction than when the copper is high in cuprous oxide; and the greater the concentration of the reducing gas the deeper the deoxidation. (2) The rate of deoxidation is much more rapid at the beginning of exposure than at the end, a condition especially noticeable at temperatures around 900° C.; that is, deoxidation is retarded as the depth penetrated by the reducing gas increases. (3) Within the accuracy of the experiments arsenic in copper up to 0.5 per cent has no tendency to increase or decrease the action of a reducing gas on the cuprous oxide present.

ANNEALING OF COMMERCIAL COPPER TO PREVENT EMBRITTLEMENT BY REDUCING GASES

By Susan B. Leiter, Schenectady, N. Y.

The main cause of the embrittlement of ordinary commercial copper is the reduction of cuprous oxide, which exists either in solid solution or in a finely divided state along the grain boundaries.

By proper annealing, this oxide may be segregated so that its reduction by hot reducing gases will not cause embrittlement.

Three photomicrographs indicating the progress of the coalescence of the cuprous oxide are shown.

Mixing Brass for Billets

An Ingenious, Quick and Practical Method for Controlling the Zinc Contents of a 60-40 Brass

Written for The Metal Industry by W. J. PETTIS, Rolling Mill Editor

The operation, to which the method described below was applied, was the alloying and casting of 60-40 brass into billets for manufacturing seamless brass tubes by the piercing process. The furnace used was a resistance type electric furnace (Baily), with a hearth capacity of 2,000 pounds. The charge was made up of part new metal, scrap copper tubes, and scrap brass tubes; the zinc contents in the brass scrap varying enough to make accurate calculations difficult, and, in combination with some zinc loss during speltering, mixing, and pouring, made it impossible to do more than approximate a 60-40 alloy. The metal was cast with no positive fore-knowledge that the alloy would be within such limits as to make the piercing operation a success. As a matter of fact some severe losses were sustained, owing to the alloy running high enough in copper to put it just beyond the range of a good "hot working mix."

The time between speltering and pouring was so short as to make a check up by analysis impractical, and the chemist in charge developed what might be termed a color test, that could be made in about five minutes, and functioned to within a fraction of one per cent in the reading. He first secured samples of brass from their own operation, running from 58 per cent to 65 per cent copper in steps of one per cent. Chips were gotten from each sample, by sawing, the saw being mounted in the laboratory for this purpose only, and with an individual motor drive. All details of the saw were carefully noted, the gauge, diameter, number of teeth to the inch, length of tooth, peripheral speed, and the speed of travel of the saw into the test bar, etc. No lubricant was used on the saw, and on the maintenance of all these conditions the accuracy of future tests depended. The chips secured from each special sample were put in a 4-oz. vial, and carefully sealed. The complete set was then mounted on a board, with the copper contents marked, under each vial, and although with only a one per cent gradation the difference in color was sharply defined on the board.

The furnace runs five charges a day. The tests of the melt are made after all the scrap and new copper are melted down, and the estimated amount of zinc necessary to make the 60-40 alloy added, but before it has been brought to a proper pouring heat, thus avoiding any delay in the operation, as the results are determined by the time the metal is ready to pour. A sample is taken by dipping a mould or ladle fastened to an iron rod, into the melt. The sample secured is about ¾-in. square by 5 in. long. This solidifies quickly, and is cooled in water, for quick handling, chips are secured from the sample bar, exactly as in the case of the standard tests, are placed in a vial of the same pattern, and then are matched up in color, with one of the standard test vials mounted on the board. If, for example, it is matched up with a 63 per cent copper sample, the weight of the charge being known, it is a simple matter to determine the amount of zinc to be added to make a 60-40 alloy.

In this test there is no color that the operator must keep in his mind, in order to judge results, it is reduced to a matter of matching colors, and it has proved a satisfactory and efficient method of handling this problem.

Embrittlement of Copper by Hot Reducing Gases

From a Paper Read at the New York Meeting of the Institute of Metal Division, February 17, 1926

By T. S. FULLER

General Electric Company, Schenectady, N. Y.

Various phases of the embrittlement of solid copper containing oxygen by the action of reducing gases at high temperatures through the work of many experimenters are familiar to readers of metallurgical literature.

The purposes of the present paper is to report several instances of copper embrittlement, caused by hot reducing gases, that have come under the observation of the author and which may be correctly termed "factory troubles."

MICROSTRUCTURE

The structure of fully annealed copper that has been heated updernon-reducing conditons is shown in Fig. 1. The "tight," sharply defined, grain boundaries and square-corner grains of the cubic structure are characteristic of copper treated in this way. Fig. 2, on the other hand, is typical of copper heated to a high temperature under severely reducing conditions. The intergranular cracks and rounded grains are in direct contrast to the structure in Fig. 1. In the examples of brittle copper cited in this paper embrittlement had progressed to a marked degree. No samples showed the ductile structure of Fig. 1; on the other hand, none of the conditions described were as severe as those to which the sample having the structure shown in Fig. 2 was exposed, so that none of the examples showed as badly disintegrated structures.

RAIL BONDS AND SOLDERING IRONS

Among the first cases of copper containing oxide being made brittle by the action of reducing gases to come to the writer's attention were some rail bonds similar to the one shown in Fig. 3. In the process of manufacture, after preparing the cable section of the bond, the terminals were drop-forged on the ends at a red heat. Oil-fired furnaces of the muffle type were used for heating, and not infrequently the strands of the cable became extremely brittle. Observation showed that if the combustion of the furnace was so regulated that reducing conditions existed in the region occupied by the rail bonds,

FIG. 1.—COMMERCIAL COPPER, ANNEALED, × .75

FIG. 2.—COMMERCIAL COPPER HEATED IN HYDROGEN 2 HRS. at 850° C. × 200.

embrittlement occurred; but that if oxidizing conditions predominated, no embrittlement took place. The remedy for this embrittlement was therefore obvious.

Another example is the calorized electric soldering copper, or soldering iron as it is commonly called, shown in Fig. 3. In the calorizing process, the copper is heated in powdered aluminum in a hydrogen atmosphere for 2 hr. at a temperature of 800° C.; this produces a diffusion of aluminum into the surface of the copper, forming a coat of aluminum bronze that is highly resistant to oxidation at high temperature. The long heating at the high temperature in hydrogen produced blisters and cracks which were highly undesirable; on the surface of the soldering irons, the difficulty was overcome by using copper free from oxide.

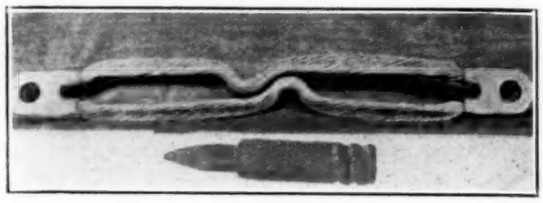


FIG. 3.—RAIL BOND AND CALORIZED SOLDERING COPPER

WATER COOLED X-RAY ANODE

Not all cases of copper embrittlement caused by reducing gases are as obvious as these just mentioned. The phenomenon was found to be the cause of very minute leaks in high-voltage, Coolidge x-ray tubes, the successful operation of which depends on maintaining a very high vacuum, which of course can be accomplished only by the use of absolutely non-porous materials in the construction of the tube. Among the parts to be suspected and considered as possible sources of leaks was the water-cooled anode, shown in Fig. 4. The anode is made by casting copper in vacua against one side of a tungsten disk, and subsequently recessing the copper to receive a flat spiral of ⅛-in. copper tubing *A*, through which water flows when the tube is in operation. The spiral is then silver-soldered in place by heating in vacua by means of a high-frequency current.

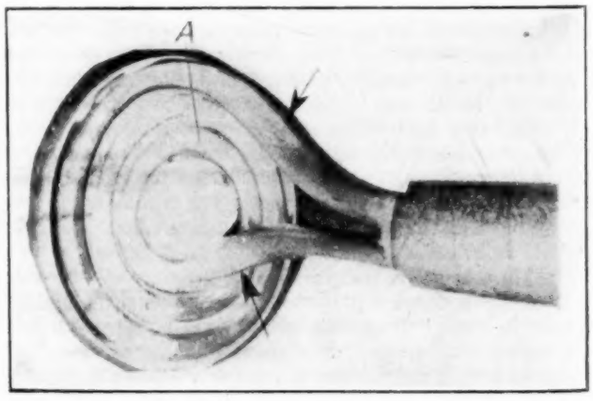


FIG. 4.—WATER-COOLED ANODE FOR HIGH VOLTAGE COOLIDGE X-RAY TUBE.

Microscopic examination of the copper tubing, at the

points indicated by the arrows, showed the first stages of the characteristic intergranular embrittlement caused by reducing gases, resulting in a porosity sufficient to ruin the vacuum in the tube. The trouble was caused, during the soldering operation, by the reduction of the oxide in the copper by vapors from oil or other organic matter remaining on the anode parts after machining and was corrected by using tubing made from oxygen-free copper.

TWENTY-KILOWATT TRANSMITTING-TUBE LEADS

Brittle copper resulting from the action of hot reducing gases on metal containing oxide was found to be the cause of the difficulty that developed with the flexible leads used in the manufacture of pliotrons of 20-kw. capacity. Such a lead is made by silver-soldering a copper cable, made of strands of wire 0.0045 in. in diameter, to a tungsten rod. Embrittlement occurred near the joint indicated by the arrow due to the reduction of oxide in the wire by the reducing gases of the flame which came in contact with the wire during the soldering operation. The trouble has been overcome by first annealing the copper cable, as described by Miss Leiter.[1] Such an annealing serves to agglomerate the cuprous oxide present in such a way that the copper is not embrittled by hot reducing gases.

LEADS FOR 250-WATT TRANSMITTING TUBES

Trouble similar to that just described was found in the leads for U. V. 204 vacuum tubes. In the manufacture of these leads, one end of the composite copper-nickel-steel wire is electrically welded in an atmosphere of hydrogen to a tungsten wire, and the other end is welded to a copper cable. Embrittlement of the cable was noticed near the latter joint; it was caused during the welding operation by the reduction of cuprous oxide by hydrogen.

ENAMELED WIRE

Perhaps one of the most unexpected cases of embrittlement occurred in fine copper wire during an enameling process. Wire 0.003 in. in diameter is regularly passed through an enamel bath, at the rate of 125 ft. per min., and then into a 48-in. furnace held at a temperature of 430° C. The wire is ordinarily given five coats of enamel, being passed through the furnace after each coat. The reducing conditons, due to the vapor of the enamel solvent and the decomposition of the enamel base, that prevail in the furnace, produced a brittle wire. Under the microscope, a section showed clearly the condition resulting from reducing atmospheres at high temperatures. The embrittlement in this instance has been overcome by removing the reducing atmosphere surrounding the wire by drawing air through the furnace.

FLEXIBLE SHUNTS FOR CONTACTORS

An additional example involving embrittlement has been found in flexible shunts for contactors. The shunts are made of flat, braided cable, the individual strands of which consist of copper wires 0.004 in. in diameter. During the process of manufacture, the shunts often lie in the shop for some time, when they become tarnished by atmospheric corrosion. It was sugested that after being tarnished the shunts might be brightened quickly and efficiently by heating in a hydrogen atmosphere. This was done at different temperatures and for different lengths of time, with very unsatisfactory results, because all sets of conditions that "cleaned up" the surface of the cable produced embrittlement, and all set of conditions that left the wire mechanically strong and ductile failed to brighten the surface. An alkali method of cleaning was later found to give satisfactory results.

[1] Susan B. Leiter: The Annealing of Commercial Copper to Prevent Embrittlement by Reducing Gases. Issued as Paper No. 1523E, with Mining and Metallurgy, February, 1926.

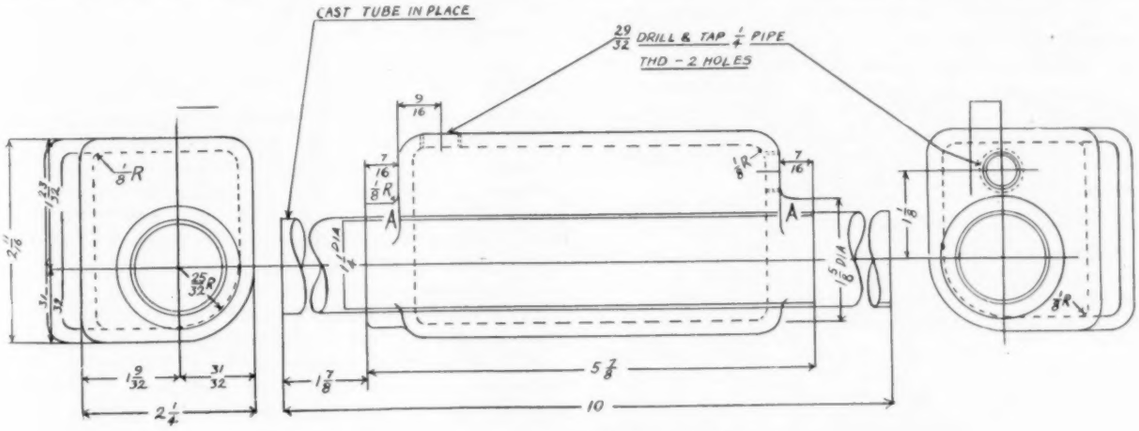
Casting Around Inserted Tube

Written for The Metal Industry by JESSE L. JONES, Metallurgical Editor

Athough the following problem refers to iron and steel, the practice pointed out should be of value, if used as a general guide for non-ferrous metals.—Ed.

Q.—How can I cast a seamless steel tube into an iron casting as shown in the sketch?

A.—My experience has been that steel inserts must be very hot to be successfully surrounded with molten cast iron. The requirement that the joint between the steel and iron must be oil tight, renders the proposition rather difficult from a practical standpoint. I might suggest, however, that the seamless steel tubing pieces be heated to a red heat in a larger steel tubing, through which a current of natural or illuminating gas is passed. This would prevent the tubing from being oxidized, which is the probable cause of leaking when it occurs.



ALL WALLS 3/16 THICK UNLESS OTHERWISE SPECIFIED

SKETCH OF CASTING TO BE MADE AROUND TUBE

The Recovery of Scrap Copper

Article 4 of a Series on the Metal Business. How Secondary Copper Is Reclaimed*

Written for The Metal Industry by ADOLPH BREGMAN, Managing Editor

INTRODUCTION

Copper has an extraordinarily high reclamation value, due to the fact that it has such unusual lasting qualities. Even though the article into which it is made can no longer be used, the metal itself may still be in good condition. Casting copper, which is always made of secondary material, is quoted to within ½ or ¾ of a cent per pound of electrolytic.

EXTENT OF THE INDUSTRY

The scope of the secondary copper industry can be judged from the fact that in 1923, copper, including that in alloys other than brass, was recovered to the extent of 193,200 tons, being valued at $56,800,800. Of brass scrap 311,000 tons were recovered, being valued at $72,843,800.[1] The copper content of the brass scrap averaged about 70 per cent, totalling 217,700 tons, making a grand total of 410,900 tons of secondary copper recovered in 1923. Of this total 65,719 tons were recovered by plants refining the primary metals, that is copper refineries, and the remainder by plants treating only secondary metals.

SOURCES OF SCRAP COPPER

The main sources of scrap copper have been listed and classified by the National Association of Waste Material Dealers[2] and consist of the following items:

Heavy copper; No. 1 copper wire, not less than 16 gauge; No. 2 copper wire, under 16 gauge; light copper; composition or red brass; railroad bearing; cocks and faucets; heavy yellow brass; yellow brass castings; light brass; new brass clippings; brass tubing; No. 1 red composition turnings; No. 1 yellow rod brass turnings; No. 1 yellow brass turnings.

In addition to these, which can be listed as "manufacturing wastes," there are a large number of metallurgical wastes which are classed as secondary material. Among these are sweepings, ashes, old graphite crucibles, furnace linings, skimmings, slags, scale, plating solutions (cyanide or sulphate), pickling solutions (sulphate), flue dust, amalgamation plates, furnace bottoms.

There is also a certain amount of material too small in quantity to classify, but nevertheless of fair importance, of a miscellaneous type and fairly clean character, including such things as boiler tubes, fire box plates, etc., lamps, clocks, coins, etc. An interesting classification of the secondary metal which is sent to the primary copper refiner is given by Lawrence Addicks[3], as follows:

A. Junk.
  a. Lamps, clocks, etc.
  b. Borings and chips.
  c. Wire.
  d. Sweepings.
  e. Coins and alloys.
B. Mill Products.
  a. Wire.
  b. Scale.
  c. Cement.
  d. Stampings.
C. Metallurgical Products.
  a. Cement.
  b. Amalgamation plates.
  c. Secondary pig.
  d. Nickeliferous pig, black copper, etc.
  e. Furnace bottoms.
D. Refinery By-Products.
  a. Silver refinery slags.
  b. Liberator tank cathode products.
  c. Flue products.

*For parts 1, 2 and 3, see THE METAL INDUSTRY for January, 1920; May, 1920; August, 1922.

[1] Secondary Metals in 1923 by J. F. Dunlop, U. S. Geological Survey, Washington, D. C.

[2] See THE METAL INDUSTRY for August, 1925, page 327.

[3] Chemical and Metallurgical Engineering, January 21, 1920.

SAMPLING

The sampling of scrap and waste is a specialty in itself and requires a high degree of skill and judgment. In the first place the material is almost always of such a character that automatic sampling by machine methods is difficult or impossible. Old clocks and copper wire cannot be run through a sampling machine, nor will any mechanical equipment separate brass from copper. Traveling junkmen and the secondary smelters have developed the ability to judge odd lots of material rapidly and accurately, but even they are fooled at times.

The first requirement in sampling a lot of material is separation into classes. The lot must be sorted into various types of materials, and then each particular type sampled and analyzed by itself. In the case of drosses the hand method of coning and quartering serves the purpose but where the quantities used are large enough, automatic sampling devices can be installed. Wire is sampled by taking a clipping in sufficient number of places to promise accuracy. The basic principle, however, is that of taking "grab" samples. In other words, handfuls of the material are taken in a sufficient number of distributed locations to assure a correct average.

Duplicate samples should be taken and the lot of material held until the results of the analyses of these samples are obtained. If these analyses do not check, the lot should be re-sampled. It is necessary to allow for the non-metallic inclusions, such as insulation, dirt and dust, moisture, etc., and in jewelers' sweeps, to watch carefully for precious metals. Tinned copper must be watched for. Amalgamation plates, which are large copper sheets with a coating of mercury, used to collect gold and silver from finely crushed ores, must be scraped clean and then sampled by cutting up into small pieces, say a few inches square, and taking out every tenth or fifteenth piece as a sample to be put in the part reserved for analysis. The selection of every tenth piece, after proper shuffling, can be continued until a small enough sample is obtained for assay purposes. Furnace sides and bottoms are difficult to sample. They must be chipped laboriously and they are sampled only when they are known to be high in precious metals.

METHODS OF RECOVERING CLEAN COPPER

The methods of recovering copper from scrap and drosses vary with the type of material to be treated. Copper, that is in good condition, clean, untinned, free from insulation or other covering and unoxidized can be melted directly in any form of metal melting furnace, from the crucible to the reverberatory or electric furnace if desired, depending upon the quantities to be handled. If the metal is, as stated above, in first class condition, no fluxing or treatment of any kind should be required. A charcoal cover and perhaps broken glass to protect the metal from the air can be used. It is necessary in melting copper as in melting other metals to be careful about oxidizing the molten metal; if the melting is done in crucibles a glass and charcoal cover is normally sufficient. If it is done in open flame furnaces, the oil or gas burners must be watched to keep the flame as nearly as possible reducing in character. In the electric furnace this diffi-

culty is minimized and the metal can be poured in practically the same condition as it is put into the furnace.

If the copper becomes oxidized in melting or if it is partly oxidized previously to melting, it must be treated. Various types of deoxidizers are used for cleaning copper, but the most important are phosphorus, manganese and silicon. Only small amounts are required, the general figure being from 1 to 2 ounces of the deoxidizer to 100 pounds of copper. They are generally introduced in alloyed form, such as phosphor-copper, manganese-copper or silicon-copper, and the amount used can be calculated from the percentage of the alloy.

If the copper wire is covered with insulation, this insulation has to be burned off, and this process immediately injects a complicating factor by reason of the fact that the sulphur in the rubber attacks the copper. If this has occurred, the sulphur must be removed by oxidation and then the copper subsequently deoxidized. On a large scale this is accomplished by flapping or blowing air through the copper bath until the sulphur is removed, and then poling the metal, that is inserting hardwood timber into the bath, until the metal is sufficiently deoxidized by the gases formed by the destructive distillation of the wood to form clean, high-grade "tough pitch" copper. Refining to this extent is carried on almost exclusively by the large copper refiners and to a very small extent, if at all, by the secondary smelters. The secondary smelters are content to turn out a metal running 98 per cent pure, or better, to be sold as casting copper.

The regulation precautions in melting light material have to be observed. If the scrap to be melted is thin, thus exposing a large surface to the air, it should not be put into the furnace until there is already a good sized bath of molten metal in it. Then the light material can be charged and puddled under the surface of the bath.

These methods, of course, apply only to pure copper which offers but little difficulty, the problem consisting only of getting the metal out of the furnace in as good condition as it went in. The need for careful analysis and figuring of charges, treatment, etc., arises when the material to be recovered is contaminated by other metals or impurities. We shall begin with a consideration of copper with only metallic impurities.

ELIMINATING METALLIC IMPURITIES

The most common impurities which are found in scrap copper are lead, arsenic, antimony, sulphur, iron and aluminum. In brass and bronze, of course, zinc and tin are present but they are found in such large quantities that they are no longer to be considered impurities, but rather part of the material to be recovered. Aluminum, which is often used as a deoxidizer is considered undesirable. Nickel, which may be highly desirable for certain products, is considered a deleterious impurity and (like chlorine) is penalized by the secondary metal smelters purchasing copper-bearing materials. It is extremely difficult to remove and causes the loss of considerable copper in the process of removal.

The general principle of the elimination of these impurities is oxidation. Oxygen is brought in contact with the melted metal, forms oxides and these oxides rise to the top of the bath as a slag or are completely volatilized as the case may be. The slag is skimmed off and then the remaining copper must be deoxidized to a reasonable purity. The oxidation is accomplished by blowing air through molten metal in iron pipes; or by "flapping" the metal, that is paddling it back and forth with a long paddle or hoe; or by adding a sufficient amount of copper scale which is the mixture of cupric and cuprous oxides. In United States Patent No. 1,349,382, August 10, 1920, taken out by Jesse L. Jones and assigned to Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., covering the method of using copper scale for removing impurities, the following statement is made:

"The amount of copper scale which may best be employed will vary in proportion to the amount of oxidizable impurities contained in the copper scrap to be purified and may best be determined, in each instance, by small trial heats or tests. As an example, I have found in one instance, that, by adding copper scale to the molten copper scrap in the proportions of substantially 800 pounds of copper-scale to 40,000 pounds of copper scrap, the lead and other oxidizable impurities have been completely and quickly removed.

"The copper scale, when added to the molten copper scrap, is melted and immediately dissolves out the lead and other impurities, the oxygen of the copper scale combining with the lead and other impurities to form the several oxides, while the copper of the copper scale combines with the copper of the copper scrap being purified. These oxides of the various impurities rise to the surface of the molten copper as a scum and may be separated from the copper in any suitable manner. For example, I may throw a small quantity of sand upon the molten mass after the oxides have been formed, in which case the sand will combine with the lead and other oxides to form silicates which may be readily removed from the copper."

In order to make the work of removing impurities from the molten metal as easy as possible, it is almost always desirable and often necessary to eliminate the iron before charging the metal into the furnace. This is done quite simply by a magnetic separator, which will take out all the loose iron. However, any iron which is already alloyed with the metal must, of course, be removed by the oxidizing operation.

Deoxidation of the metal after the impurities are removed is accomplished on a large scale by poling, as previously described. On small scale operations, however, it is seldom possible to blow air through the metal or to pole it. The oxidation and deoxidation must be accomplished by some simpler means, if for example, the melt is made in a crucible. In this case, copper scale is eminently suitable.

For the removal of aluminum from copper or brass, a simple method is to melt the metal in the crucible, then before it is ready to pour, throw in about 4 ounces of sal-ammoniac to the 100 pounds of metal; mix gently and stir until the sal-ammoniac has come in contact with the metal from top to bottom. Skim and pour.

On a larger scale the following flux can be used:

Silica Sand	50 parts
Fluorspar	30 parts
Sal Soda	7 parts
Lime	13 parts

Use 100 pounds of the above mixture to a ton of metal. After melting, pole with a hickory pole and skim after getting up to a good heat.

REFINING BRASS SCRAP

One of the early but important advances made in this art was worked out by G. H. Clamer who found that by melting ordinary scrap brass which might contain lead, tin, zinc, manganese, iron, aluminum and other impurities, and by treating it with lead oxide, he oxidized these impurities driving them into the slag and reduced the lead which entered the mixture. This process he later improved (U. S. patent 970,686) by melting the brass scrap with a flux such as silica and lime or silica and soda ash, and then blowing air through it. Zinc, iron, aluminum,

and manganese were very quickly oxidized and slagged. When it is almost all removed, which may be noted by the fact that the zinc flame disappears, the lead oxide is added and eliminates the rest of the zinc. The iron, aluminum and manganese are of course, completely removed by this time, since zinc is the last to disappear.

These methods are directly useful for obtaining alloys of high lead content, not for producing pure metal, but, they are of great importance and have resulted in considerable improvement in the production of alloys from secondary materials.

METAL MELTING PRECAUTIONS

At this point a few words of caution concerning the melting of metal either in crucibles or in reverberatory furnaces may not be amiss. Among the precautions taken should be the following:

1. Protect the metal from oxidation by using a molten covering of glass or borax and adding enough charcoal to cast a reducing atmosphere.

2. In many cases it will be necessary to treat the metal after melting, due to included oxides, gases, etc. Copper alloys high in zinc may be treated with manganese copper, about 1½ or 2 ozs. per 100 pounds of metal. Alloys low in zinc may be treated with phosphor copper in about the same proportions.

3. In changing the composition of a metal or alloy which has been recovered, all additions must be mixed in by adequate stirring.

4. Pour at a low temperature whenever possible; this can always be done with ingots and a temperature of about 100° above melting point gives better results than if a much higher temperature is used.

5. In adding a flux, in order to get the full benefit of it, it must be stirred in thoroughly. The same applies to de-oxidizers, degasifiers, etc.

RECOVERING PICKLING SOLUTIONS

In many instances the metal tied up in pickling solutions used in rolling mills amounts to a considerable sum. This pickling is done in tanks lined with lead or asphalt, using a dilute sulphuric acid solution which is heated by steam. From such tanks the metal can be recovered by running the contents into another tank and adding scrap iron or steel. The metallic copper is precipitated from the solution on the scrap, the iron replacing the copper in the solution. The iron sulphate solution is drawn off, the copper deposit or "cement" being shoveled out, dried and melted.

The copper in this form is difficult to handle because it is flaky and light, the losses being high. It can however, be briquetted and is handled better if left a little moist. It is best to mix it with other materials in melting. Another danger is that particles of iron or steel will be left in the copper cement and find their way into the melt, thus contaminating the copper.

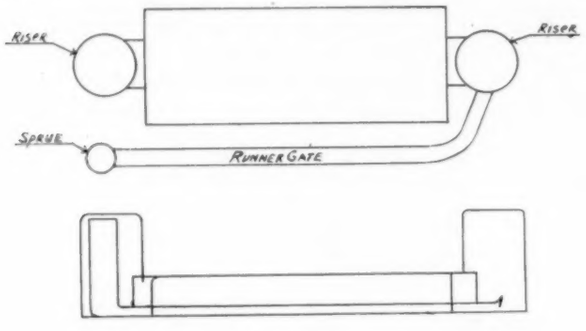
Probably the commonest method of recovering values from copper sulphate solutions is the manufacture of "bluestone" or copper sulphate crystals but as this is a problem confined almost exclusively to the very largest refineries and not of general interest to secondary smelters, it will not be considered here.

Copper can of course, be recovered electrolytically but this should not be attempted by any but the large refineries. It will pay much better to sell such solutions than to attempt the installation of a small electrolytic refinery.

Aluminum Casting

Q.—We are experiencing a little trouble in making aluminum castings. These castings are approximately 2⅛ in. thick, 6½ in. wide and 9 in. long. We have been casting these on end, pouring them from the bottom, using a very heavy riser off the top. These castings, when machined, seem to be very porous on the sides. The material used is genuine No. 12.

A.—We suggest you pour these castings flat and gate like sketch, or if you want to pour them on end, slide the metal into the mold, do not let it drop. This can be done



GATING ALUMINUM SLABS

by tipping the mold to a 45 degree angle, and pouring the metal so it will not drop, but slide into the mold with the least amount of drop.

We also suggest you add to your No. 12, 4 per cent of silicon aluminum, made of 50 per cent silicon and 50 per cent aluminum. Make your mixture 96 pounds of No. 12 and 4 of silicon-aluminum.—W. J. REARDON.

Nickel in Brass

Q.—Can you give us any information in regard to the process and fluxes which can be used to remove nickel that has become fused in red brass and bronze mixtures. The nickel will run from a trace to perhaps 1 per cent and finds its way into the mixture through the use of scrap.

A.—There is no economical method that will remove small amounts of nickel from red brass and bronze mixtures. The only method of removing nickel from brass is to remove all the zinc, tin, and lead by refining in a reverberatory furnace, by poling and slagging or running a steam pipe to the bottom of the furnace, blowing the metal, adding silica sand and iron scale, slagging and burning out all the impurities.

Why remove the nickel from the red brass? It will improve it, give it a closer grain and keep the lead from separating. For pressure work it will give far better results, as the number of rejections will be much less, due to the close grain.—W. J. REARDON.

Welding Copper Tubes

Q.—Is there any methods of which copper tubes can be properly welded together? We are called upon to make a joint wihch naturally must be perfectly tight and strong enough to withstand the expansion and pressure of 90 to 100 lbs. steam pressure.

A.—We know of no method other than that of brazing with the phosphor bronze welding stick. Tobin bronze might be used, but that also includes some zinc. Perhaps you might be able to use Monel metal tubes or nickel tubes which would stand a higher brazing fire than copper. If your copper tubes are heavy gauge, phosphor bronze brazing sticks will be satisfactory.—W. L. ABATE.

Three Periods of American Silversmithing

A Series of Three Articles on the Development of Silversmithing in America. First, American Colonial Silver, 1620-1800; Second, American Silver of the Past, 1800-1880; Third, American Silver of the Present, 1880-1925

Third Period, American Silver of the Present*

Written for The Metal Industry by A. F. SAUNDERS, Designer, Benedict Manufacturing Company

The twenty years between 1880 and 1900 may well be termed an epoch-making period in the silverware industry of America. It was a period of new artistic ideals, and of new mechanical methods, intelligently applied with the result that one of the finest arts ever practiced by man was brought back to somewhere near the high standard of artistic craftsmanship that characterized the fine work of the gold and silversmith in the old days of the Guilds.

Blessed with unlimited natural resources, America had finally developed into a great manufacturing nation, destined to become the most prosperous country of modern times. With this steady growth of prosperity came a desire to cultivate a more refined taste in art

*Parts 1 and 2 were published in our issue of April and August, 1925.

PLATE 5. DESCRIPTION OF ILLUSTRATIONS

No. 1 and 2 were about the last word in Sterling silver flatware during the early nineties. The French Rococo style of decoration enjoyed a wave of popularity during this period as spoon No. 1 indicates. No. 2, Gorham's "Medici" pattern, designed after the Renaissance, introduced a new style in silver design in this country. This pattern was an exceptionally fine piece of steel die work and received most favorable comment in the Gorham display at the Columbian Exposition in 1893.

No. 3. The "Commodore Colt" Trophy, made by the Whiting Manufacturing Company for the Larchmont Yacht Club in 1893. This cup is one of the handsomest pieces of silverware ever made in this country. Its body is in the form of a caravel, with mermaids along the sides urging on a trio of sea horses in a chase for supremacy. A graceful figure of Victory ready to bestow the prize adorns the bow. The Rococo influence is also evident in this design.

No. 4. A Sterling silver soup tureen, part of a dinner service exhibited at the Chicago World's Fair in 1893. It shows plainly the great improvement that had been made in artistic design in silver since the previous world's fair in 1876. Its decoration also shows a Rococo influence.

No. 5. One of the famous "Ogden Goelet" Trophies, a masterpiece of American silversmithing made about 1896. The late Ogden Goelet gave two trophies each year from 1882 until the time of his death in 1897. Compare this work of art with the masterpiece of trophy design in 1876, Fig. 7, Plate 4.

generally. This was particularly true with the so-called middle class of people which represents the real purchasing power of any nation such as ours. Perhaps even more important, at least from the standpoint of those industries in which art is a vital factor, was the gradual awakening of public interest in what is broadly termed "applied art." In view of America's present high standing in the field of industrial art, it is rather difficult for one to realize that there was a time, and not so many years ago, that the erroneous impression was pretty general, even among our most cultured people, that true art was confined solely to picture painting and sculpture. With the aid of intelligently applied advertising and the quiet persistent work of men whose ideals have fortunately become real to them, the buying public has been educated to the fact that there is just as much true art in a well designed and skillfully executed piece of silverware, as can be found in a fine painting or a beautifully sculptured marble.

Still another important factor responsible for the vast improvement in American silver of the past thirty years was the great influx of artists and skilled craftsmen from all parts of Europe during the eighties and nineties. Her very best designers modelers, chasers, die-cutters and hammersmiths flocked to our shores, attracted by the splendid opportunities offered by a rapidly expanding industry. They were the material most needed to give the industry a new impetus, a new angle of artistic thought. We had an abundance of mechanical ability to develop new machinery, new processes and quicker methods, but lacked men having a really artistic training. Immigration supplied this great need and it is from those men that the majority of our present day designers and craftsmen inherit their artistic ideals, which combined with Yankee mechanical ingenuity, has once more placed American silversmithing in the very front rank of artistic endeavor.

Through the skill of the die cutter, a broader field of possibilities was opened up to the designer. In spoon work beautifully executed steel dies, at first cut flat, but later curved to produce the exact shape of the finished piece supplanted the slow and crude method of machine rolling. Improvements in the drawing press extended the range of form development. The fine art of repoussé chasing was revived. Saw piercing by hand gave way to the much speedier method of piercing with dies, all of which combined with the comparatively low cost of silver bullion, placed silverware within the reach of the great majority. Keen competition developed between the various silver factories and designers vied with one another in creating artistic ware. The art of the silversmith was at last attracting appreciative attention. The fruit of all this effort was plainly to be seen in the magnificent display of silver at the Columbian Exposition at Chicago in 1893. Practically all of the leading silversmiths in the country exhibited, and this fine display of artistic craftsmanship was truly a revelation, especially to those who remembered what a travesty our silverware was in 1876 in Philadelphia. Splendid specimens of artistic design and fine die work were represented in the "Versailles," "Medici" and "Old Master's" patterns in table flatware exhibited by Gorham. Also the magnificent show pieces, beautifully executed in repoussé chasing by Whiting,

PLATE 6. DESCRIPTION OF ILLUSTRATION

No. 1. A Sterling silver yachting trophy of 1906. Its decorative features show the influence of the "Art Nouveau" then at the height of its vogue.

No. 2. The last word in Sterling silver design in the year 1901. The "Art Nouveau" movement had arrived in America and this set is an example of the extremes to which its influence was carried.

No. 3. One of the latest patterns in Sterling silver coffee service designed in the style of the French Regency, 1715-1723, the transitional period between Louis XIV and Louis XV. Compare this set with the Sterling silver tea set made in the sixties Fig. 6, Plate 4.

No. 4. One of the highly popular spoon patterns in Sterling silver about 1905-6. Floral effects still dominated the styles in silverware.

No. 5. Sterling silver spoon pattern of 1911-12. Taste had now reverted back to the simplicity of the Colonial style which continued in vogue for the next eight or nine years.

No. 6. Sterling silver spoon pattern of the present year. Its design in the "William and Mary" style illustrates the vogue for Period styles in silver design.

brought forth the highest praise of those qualified to pass expert judgment upon the merits of artistic design and workmanship. Foreign critics rubbed their eyes, put on their glasses and decided that America was at last beginning to understand and appreciate the aesthetic in art.

The keen interest in yacht racing during the latter part of the last century had a direct influence on the art of silversmithing in America. A demand was created for silver trophies that brought out the best efforts of our designers and craftsmen. Many of these trophies became internationally famous and represent as fine examples of art in the precious metals as can be found anywhere in the world. The Commodore Colt Trophy and The Ogden Goelet Cup for schooners illustrated on Plate 5 are splendid examples of the very best in silver work of that time and it is doubtful if anything finer in silver has ever been produced before or since.

The Goelet trophies were long regarded as the championship emblems for American yachts. Ogden Goelet gave two each year; one valued at $1,000, which was for schooner yachts, and the other at $500, which was for sloops. Every year from 1882 to 1897 they were raced for, off Newport. After the death of Mr. Goelet, Colonel John Jacob Astor gave cups of the same value. A number of cups were offered by the late James Gordon Bennett when he was Commodore of the New York Yacht Club. The Ailsa Cup, offered by Mr. Bennett, really a huge punch bowl of Sterling silver weighing 500 ounces was a masterpiece in artistic design and fine chasing. All of these yachting trophies were distinctly American in conception and craftsmanship and their decorative features usually suggested things emblematic of the event for which they were given, and often also of the idea suggested in the name of the defender.

Contemporary with the interest in yacht racing, was the custom of presenting our new warships with silver services, this being done by the city or state after which the vessel was named. This custom not only provided work for the factories, but stimulated competition among designers all over the country. Never before in the history of the industry had our silversmiths been called upon to execute silverware on such a magnificent scale, but it did not take long to prove that our designers and craftsmen were fully capable of handling the problem. The first ship to receive a silver service was the armored cruiser New York. The set was presented in 1891 by the City of New York, which invited all of the leading silversmiths of the country to enter designs on a competitive basis. Great publicity was given the whole affair, particularly because of the fact that the honor of selecting the design was bestowed upon Mrs. Grover Cleveland. From then on up to the opening of the World War in 1914, practically every new warship bearing the name of a city or state received a silver dinner, or punch service and many of these services are such magnificent examples of the combined arts of the various branches of silversmithing that they may well be classed among the great works of art of the world.

Following the "Rococo" and florated "Old English" style of the nineties came the so-called "Art Nouveau" of the early nineteen hundreds, originating in France, the movement soon spread to this country and the silver designer, ever on the alert for new inspiration seized upon this "New Art" with eager enthusiasm. Old ideals and traditions were cast to the four winds; a sure road to the formation of a truly new style had been found, at least so thought the younger element of designers. But like most fads the movement was short lived, and once the first flare-up of youthful enthusiasm had subsided, cool reasoning asserted itself and we were brought back to a realization that new styles in decorative art are not born over-night and that to burn our bridges behind us is not always wise practice, for it is one thing to discard the old ideals, but quite another to define the full scope of the new. The wiser ones soon found that the point had not yet been arrived at where the classics could be cast aside entirely. However, many though its shortcomings may have been, no one can say that the "Art Nouveau" did not serve a definite and useful purpose. It at least aroused and inspired our art industries to the need of newer and higher ideals and started us on the way to a true American Renaissance, clearly reflected in the beautiful exhibits of silver seen at the St. Louis Exposition in 1904. Foreign critics again rubbed their eyes and admitted over and over again that nothing finer in silversmithing had ever been produced in any country. Styles in silverware like most other things undergo a complete change about every ten years. Fashions seem to travel in cycles and pass from one extreme to the other and one can seldom tell just what may start a fashion. The Hudson Fulton Celebration in 1909 with its fine exhibits of early American silver, furniture, etc., was largely responsible for arousing a nation-wide interest in everything made in Colonial times. The designers of silverware were quick to take advantage of this sentiment and it was not long before the latest showing of silverware was distinctly Colonial in design and it was a pleasing relief from the highly ornate scroll and shell Rococo patterns of the nineties and the sinuous lines and heavy floral effects of the first few years of the nineteen hundreds.

Practically all of the silverware patterns from 1910 until about 1919 show a strong Colonial influence in their design and the popularity of this style set the present day vogue for period styles. From the severe simplicity of the Colonial, a gradual change to the more ornate period styles was but a logical sequence. It marked the beginning of a new cycle. Following the Colonial, the various phases of the English Georgian, particularly the Middle Period, has furnished a background for many of the most charming patterns produced in silver during the past five years. The works of Robert Adam, Chippendale, Sheraton, Heppelwhite and Paul Lamarie, the celebrated 18th century English Silversmith, have been most carefully studied by the American designers of silver and they have found in them a wealth of inspiration.

With the growing trend for more elaborate decorative effects, the designer is now turning to the Italian, French and Spanish styles of the Renaissance for his inspiration. Several of the season's latest patterns in both hollowware and flatware show this tendency to a marked degree. The Tea Service (No. 3) illustrated on Plate 6 is one of the newest patterns in Sterling and its designer has handled in a most charming and original manner some of the finest decorative motifs of the French Regency.

This vogue for period styles is not without its value. It has directed interest along definite lines and our designers, with the aid of artistic advertising, have gradually educated the housewife to an appreciation of the fact that our silverware is just as important a factor in the artistic furnishing of a home as the furniture, rugs, draperies and other elements.

America has every reason to be proud of her silverware industry today, whether it be Sterling or silver plated ware. In both artistic design and good workmanship, she stands second to none. Our silver is something that is constantly before us. It serves faithfully its purpose of utility, and if artistically designed its beauties of form, decoration and the soft reflective qualities of the gleaming metal contribute a refinement and charm to its surroundings that nothing else can quite replace.

Experiences of a Silver Plater

A Chronological Description Indicating Progress in Cleansing and Plating Operations During the Last 40 Years. From the Monthly Review, January, 1926.

By A. G. REEVE, Bridgeport, Conn.

Plating consists of a series of operations or steps, like links in a chain. Each plating shop has problems all its own and does things in a somewhat different manner than any other. This is generally true even when comparing two or more establishments making the same line of goods —each has developed its own chain of operations or links, the details of which differ from those used in the other shops in no small degree; thus it is, that when Mr. A tells Mr. B that he has excellent success in using a certain acid in a certain step in his process and B tries it and gets inferior results, it merely illustrates the fact that A uses a different style of chain than friend B, and Mr. A's link, although a very good one, does not work well in Mr. B's chain.

With this idea in mind, if any of the fellow members are able to adapt anything that follows in this paper so that it will fit into their chain and be of any value, the author will feel well repaid for having given it.

EARLY SILVER PLATING METHODS

In 1880 it was customary in silver plating small articles of brass, copper or nickel-silver to cleanse them by boiling in strong caustic potash (12°) until thoroughly discolored; remove discoloration in cyanide dip; pass through the bright acid dip and then through the "Quick-Dip" (a very dilute solution of mercury) and thence to the silver strike and plating bath. This is a good process, but best adapted for use on articles having a heavy plating which are well burnished before silver buffing, as some of the original lustre is lost before actual plating begins.

"QUICK DIP" OMITTED

Inasmuch as there was no anode to maintain the metal content of the "Quick-Dip," volume production impoverished it rapidly and it was later omitted and two strikes operated instead of one as formerly, the first being maintained with about 3 dwts. silver and 9 oz. cyanide per gallon, while No. 2 strike had 6 dwts. silver and 7 oz. cyanide.

DEVELOPMENT OF CLEANING METHODS

The brass goods made for gift enterprises and the premium trade received only a thin silver plating over a coating of nickel and were given a buff finish hence it was necessary to preserve the lustre of the base, and this was done by removing the black buff dirt in soap solution—taking off the soap film and water-break by a short immersion in hot caustic potash about 7° Bé. Next they were passed through the cyanide dip and after thorough rinsing placed directly in the nickel bath.

By this method we dispensed with the "bright dip" or other acid, impairing the lustre of the brass base very little, and with the grease film completely removed and the goods thoroughly rinsed, the nickel plating adhered perfectly and the No. 2 strike was sufficient to make the silver hold firmly to this newly deposited nickel.

Later certain lines of inexpensive nickel-silver goods were nickel and silver plated in like manner, but on account of the nickel content of the base it was necessary to follow the cyanide dip by an acid dip of some kind (4 to 6° Bé). We used hydrochloric in preference to sulphuric. This HCl dip is doubly useful as it not only enables the nickeling to adhere tenaciously, but it also acts as an excellent test for the insidious water-break condition which is easily present when the oil or grease are not completely removed by the alkaline cleansing and a slippery soap film remains which may not at first be detected by a casual water-break test. In this case the CHl dip neutralizes the alkali that makes the grease film slippery, and by itself, the grease film, if present, makes a very noticeable water-break. After goods have passed through the HCl dip and are raised out of cold running water (free from alkaline rinsings) and are able to be held in the aid under observation for 60 seconds without the appearance of any sign of water-break they are generally free from soap or grease and usually take plating well—other conditions also being favorable.

The cleansing and perfect preparation of work for plating, without diminution of lustre, is so important and surrounded by so much difficulty that we may reasonably expect it to constitute the greater part of the plater's work and worry, and inasmuch as nothing human is perfect, we can appropriately consider preparation problems in degrees of perfection.

Fifty years ago before the advent of nickel plating, when nonferrous articles were all bright-dipped and "struck" with silver direct upon the base, we recognize that the platers were then receiving benefit from what is now known as the "combined cleaning and striking" principle and their work "got by," although their preliminary cleansing operations were quite primitive. The fact that the nickel bath is not alkaline, evolves very little hydrogen gas, and has no cleansing tendency, may account for the unfavorable reputation commercial nickling had during infancy when its adherence was not too good, and also for the great improvements in cleansing operations which followed later.

A by-product resulting from refining whale oil is extensively used as a base for fish oil soaps variously called Platers' Compound, Cleaning Compound, etc., which is very useful in removing buff dirt without any hand scrubbing operations and no discoloration. If we add 50 per cent as much borax as soap the solution works even better and should remove all the dirt in less than 30 minutes' boiling.

An inexpensive brown soap made from "cotton oil foots" also works well for this purpose, especially with the borax addition. This being a vegetable soap it is well not to boil it when the work has thick buff dirt as some of the heavier dirt clots become cooked on, and are thereafter only removed with difficulty. Some positive mechanical agitation other than boiling is desirable.

Another excellent soap is animal oil laundry soap chips. These are convenient to use, dry and therefore economical, and the solutions work well when boiling. Laundry requirements are very exacting, hence this kind of soap is uniform and reliable and has a minimum of free caustic. It may be well to emphasize at this point the necessity of avoiding the use of caustic or carbonates of

any kind in the soap solution as they only retard the soap action, impair the lustre and sometimes discolor the work; whereas, borax accelerates the action and produces no unfavorable accompaniments. Some may consider borax expensive, but when we consider what it actually does as compared with inferior work, the cost is amply justified.

Even on surplus stock that has previously been washed and stored, the removal of the grease or dried soap film is facilitated by five minutes' soak in hot soap solution.

In order to avoid inferior plating where large volume production is the regular daily program, it is well to discard the soap or other cleansing solution after it has done a definite amount of work, which has previously been determined by careful observation, rather than to make additions and discard the used solution later when inferior work has evidenced the necessity of renewal. In short, change the solution before bad work appears rather than after.

When the work is taken out of the soap, the film that causes water-break is easily removed, especially if rinsed in warm water. This does not congeal the soap and rinses more of it off, so that a very brief boiling in one of a number of different alkaline solutions of very moderate strength will be ample. The writer at one time used for this purpose 35 gallons of boiling water in which had been dissolved 4 to 6 ounces of caustic potash. When this was first made up in the morning it analyzed about 8 per cent carbonate and at the end of the day over 15 per cent. It removed water-break in one minute and the work could remain in it 20 minutes without harm if so desired. As the carbonate increased, the tendency to strain the work was greater, hence it was made fresh every morning. This was not used extensively for any considerable period of time and therefore it cannot be recommended.

The solutions more commonly used for this part of the cleansing often contain but a small percentage of caustic, together with solium silicate, sodium carbonate, sodium aluminate and trisodium phosphate, in varrying proportions. These are stable and reliable and some combinations of them do the work with great rapidity.

The water-break having been effectually removed, the goods may now be dipped for a minute or two in a sodium cyanide dip to remove discoloration, if any, and after extremely thorough rinsing, brass goods may be placed directly in the nickel bath. However, as previously stated, nickel silver goods require after the cyanide, a pickel (HCl preferred) to make the nickel adhere well.

ELECTRIC CLEANING

Before we come to the pickle or 4 per cent HCl dip, and when quality and 100 per cent perfection are the primary objects we may follow the cyanide dip and rinse with a good electric cleaner. Our experience with electric cleaning since 1882 has taught is that it has its own peculiarities and limitations. It may operate as a benefit or a detriment, depending upon how we use it and what we endeavor to accomplish with it. It is certainly an excellent thing when rightly used to do work within its scope.

It is owing to the evolution of much hydrogen gas at the cathode that the desired results are accomplished and apparently the more gas per unit of surface the better and quicker is the work done. Therefore, let the work be strung up or racked as for plating, well spread out, and place in the electric cleaner kettle only a small portion at a time so that large volumes of current will pass directly from the inside of the kettle to all cathode surfaces with the least possible shadowing. With favorable solution at boiling temperature, 6 or 12 volts from large bus-bars and ample generator capacity makes a surprising amount of gas and adds greatly to the violence of the ebullition. An electric contact of 3 or 4 seconds is usually sufficient, but in case of doubt do not let the goods remain in longer, but preferably rinse them off and give them a second immersion in the electric cleaner of like duration. This works better than one immersion of double the time.

Sodium carbonate with 10 or 20 per cent of caustic added will make an excellent electric cleaner, the density required depending much upon current voltage available. The higher voltage and weaker solution is preferable because frequent renewals will be less expensive, and it is well to avoid letting the solution become impure with substances which may deposit upon the cathode, and the brief electric contacts are preferable for the same reason. It has sometimes been found good practice to make a fresh electric cleaner solution every day—in this case the tank was not a very large one. Trisodium phosphate makes an electric cleaner solution that does very good work, but is, of course, more expensive.

When peeling plate is caused by electric cleaner cathode deposits, we believe it is due to long periods of electrolysis. We have seen brass goods become coated with a bright, clear deposit, resembling tin or lead in only a few seconds electric cleaning in an impure solution, and to which the nickel plating adhered so tenaciously that it could not be removed by any mechanical means. We believe that when only short electric contacts are made and immense volumes of gas thrown off, the reversal of current is unnecessary.

VARIOUS FACTORS

Chemists have often proved the truth of their contention by showing us the "whys and wherefores" of things that have been mysterious. It has been our experience that while an inferior silver plate quickly throws suspicion upon the silver bath, in a large majority of cases when the real cause of the trouble is finally located, it is found elsewhere—perhaps in the strikes or nickel bath, but most frequently in one or more of the cleansing operations.

The ingredients of the silver bath may vary greatly and yet always be very efficient in depositing 2½ dwts. per ampere-hour and dissolving a like amount from the anodes. Some silver operators favor high cyanide with moderate metal content, while others like the reverse. The chief determining factor as to the proportions of these and the other ingredients of the bath will be, of course, the exact character of deposit best suited to the individual requirements of the class of work being plated. Some maintain 3 or 4 different kinds of cyanide silver baths.

Addition agents that brighten the deposits permit the use of higher current densities. The writer believes, however, that when high current densities are used, the distribution of the deposited metal will not be quite as uniform as with lower current density, provided, of course, that the other factors are the same in both cases.

Cadmium Plating*

Cadmium can be deposited quickly in still or agitated solutions.

Working at 3 volts with 12 amperes per square foot, in a solution agitated with compressed air, 1-1000 of an inch would be deposited in five minutes, and using from 150 to 160 amperes at 15 volts satisfactory deposits could be obtained on work done in a barrel plating apparatus. One such apparatus did 1 cwt. of bolts, nuts, or similar articles, in 25 minutes without any damage being done to the threads of the screws or bolts.

* From discussion of this subject by W. E. Jefferson before a meeting of the Electroplaters' and Depositors' Technical Society on December 9, 1925, in London, England.

A General Survey of Chromium Plating

Abstract of a Paper Read at the Meeting of the Electro-platers and Depositors Technical Society, Held at the Northampton Polytechnic Institute, February 10, 1926

By E. A. OLLARD

Research Department, Metropolitan-Vickers Electrical Company, Ltd., Manchester, England

Chromium has two properties which make it of interest to platers, namely, its hardness and resistance to corrosion. For this reason, a good many attempts have been made to get a satisfactory commercial plating process. The first work on this subject was done by Bunsen in 1854, and since that time various other experimenters have published or patented processes which they claim to be satisfactory.

These processes may be divided into two main types, a solution of chromic chloride acidified with hydrochloric acid, and a solution of chromic acid with small additions of chromium salts. The first types does not appear to have given any satisfactory results in practice, and nearly all processes that have been worked on a commercial scale have been of the latter kind.

In this type, a high current density has to be employed and lead anodes are usually found preferable. Among the disadvantages are the fact that a large amount of gas is generated which has to be removed owing to its virulent nature; the "throwing power" of the solution is very poor, and the temperature and other conditions have to be very carefully regulated. These difficulties, however, while they cannot at present be entirely overcome can be greatly minimized in practice, and we are of the opinion that Dr. Liebreich's process is at present the most satisfactory in this respect.

The theory of the working of this type of solution does not appear to be quite clear. It has been suggested that the small proportion of chromium sulphate usually added to the bath ionizes to give a chromium ion which is deposited on the cathode, but it seems more probable that the process is not a straightforward deposition one, but that chromium compounds are carried over and reduced on the face of the cathode by the hydrogen liberated.

Chromium can be deposited either matt or bright, but the latter process has not yet been satisfactorily applied to most commercial articles, although it can be employed in special cases. The matt deposit, however, is not difficult to polish if suitable composition, etc., is used. Chromium can be deposited directly onto copper, brass, steel, nickel and cobalt, and most other metals, but so far satisfactory deposits have not been made on aluminum, cadmium and zinc.

It has been found by test that chromium does not protect steel satisfactorily from corrosion unless a very thick and regular deposit is made. It is, therefore, considered advisable in plating iron and steel articles to give them first an underlying coating of copper or nickel. A number of tests made in the Chemical Laboratory have substantiated this view and shown that steel plated first with nickel or copper and then chromium, will give very satisfactory results under the usual tests.

It was also found that chromium was not appreciably attacked by neutral chlorides such as sea water, and that it would withstand the action of salt spray very much better than was expected.

Laboratory tests, however, are somewhat deceptive as it is difficult to obtain under these circumstances reproduction of the actual conditions to which plated articles are subjected. A large number of articles, therefore, such as motor-car lamps, and fittings, household fittings, etc., were plated for various people who could keep them under observation and report on them at intervals. These all are behaving satisfactorily, and have shown to be very superior to nickel in resisting tarnish and corrosion.

Several special applications have been suggested including the plating of reflectors.

Among its industrial applications, tests seem to indicate that chromium may be a valuable metal with which to coat metals for die-casting and other purposes, and also for the coating of printing plates and machine parts that are subjected to heavy wear.

The cost of the process cannot at the present be estimated accurately, as this will not be possible until it has been commercially worked for about a year, but from the figures that have so far been obtained it seems probable that the price, while more than nickel plating, will not be as high as has often been suggested.

In conclusion, it seems probable that while chromium plating will not at present replace nickel plating, a large number of applications will be found for it within the next few years, and that it will become a stable industry.

DISCUSSION

W. E. Hughes asked the following questions (communicated):

(1) Do you know of any chromium-plating bath that you would advise to be installed in a plating shop for use in ordinary works practice, and by any plater of average skill and experience?

(2) If so, what is the composition of that bath—what are the components and their qualitits (in ozs. 1 gal.)?

(3) Are you satisfied, so far as you have gone, that it is not advisable to use chromium anodes?

(4) What "troubles" do you find to occur in and during chromium-plating? What remedies do you employ to set the wrongs right? Are there, in your experience, any "troubles" that arise at the commencement of working a newly-made bath, and that do not occur subsequently? If so, what steps should be taken to avoid them?

Mr. Ollard, in reply to Mr. Hughes, said:

(1) It is doubtful whether any chromium-plating process that is known today would be suitable to install in an ordinary plaiting shop. As mentioned before, it is necessary to have special plant, and while this plant does not require any great skill in operating, the process is not entirely in line with the ordinary plating processes.

In Birmingham, where we have a commercial plant, it is housed in a separate building, under the supervision of the Works Chemist, and it is operated by one of the regular electroplaters.

(2) The most satisfactory solution that we have so far come in contact with, has been a reduced solution of chromic acid. The composition and full details for the making up of this bath are contained in Dr. Liebreich's English Patents, most of which are, I believe, now completed and open to inspection.

(3) As mentioned before, there appears to be no advantage in the use of chromium anodes, either on the score of ease of working, or from the point of view of cost.

(4) Chromium plating being a somewhat special operation, especially in that it involves a very high current density, certain difficulties occur that would not be met with in the ordinary plating processes. The method of suspension of the articles in the bath is important, and it is necessary to see that the leads are sufficiently heavy to carry the current. The bath itself, if the density is controlled and the condition is kept constant, does not give much trouble in ordinary working, but certain objects are difficult to plate owing to the bad throwing power of the solution. This has been mentioned before.

Newly made baths usually require to be "aged" in the same manner as other plating baths, but this will depend to some extent on the manner in which they are made.

Meeting of the New York Platers

The New York Branch of the American Electro-Platers' Society met on Saturday, February 20, 1926, at the Aldine Club, New York City, for their 17th Annual Banquet and Founders' Day celebration.

The educational program started at 3 P. M. Franklyn J. MacStocker, Chairman of the Banquet Committee opened the meeting with a report on the work of that Committee and then turned the meeting over to Charles H. Proctor, founder of the American Electro-Platers' Society and Plating-Chemical Editor of THE METAL INDUSTRY. Mr. Proctor introduced William Fisher, President of the New York Branch, who made an address of welcome to the members and visitors and invited all those present to attend the banquet in the evening.

Mr. Proctor then made another address of welcome to those present and opened the Educational Program with the reading of a paper on "The Mission of the American Electro-Plater." According to Mr. Proctor his present mission is to accomplish more each day in his chosen field. The plater should know chemistry in order to analyze his solutions; he should be familiar with electricity in order to control the current and keep his electrical apparatus up to standard; he should be conversant with mechanics and mechanical engineering in order to operate his equipment and keep it in good condition.

C. J. Backus of A. P. Munning Company, New York, read a paper on "The Plater's Footsteps," tracing the history of electro-plating from the discovery of electro-deposition to the present day. Mr. Backus showed a deep knowledge of the history of electro-deposition and put it vividly before the meeting.

F. C. Mesle, editor of the "Monthly Review," read a paper on "The Progress of the American Electro-Platers' Society as Noted by the Editor." From his point of view the aims and ideals of the Society were:

(1) Improving the art of electro-plating.
(2) Dissemination of the knowledge of electro-plating.

He urged those present to co-operate with the Society by improving the art of electro-plating in their own plants and disseminating knowledge through "The Monthly Review," the official organ of the Society.

Dr. William Blum of the Bureau of Standards, Washington, D. C., delivered a most interesting and instructive talk on "Polarization." He defined this as the voltage loss due to the concentration of solution at the anode or dilution of the solution at the cathode; these being called anode and cathode polarization, respectively.

Dr. Blum described the use of a "polarization" box for measuring the polarization in any solution. This device consists of a simple rectangular shaped box divided into three equal parts. At each end of the box is a copper sheet acting as an electrode; one, the anode, the other, the cathode. The divisions of the box are made of two sheets of copper gauze placed so as to divide the box into three equal parts. A current is passed through the solution in the box and the voltage drop measured with a high resistance voltmeter. Suppose the voltage drop between the anode and the first gauze is 1.2, using a total voltage of three. The drop between the second piece of gauze may be .8, and between the second piece of gauze and the cathode, 1. In that case the anode polarization would be 1.2-.8 or .4 volts while the cathode polarization would be 1.-.8 or .2 volts. In this way the polarization in the solution can be determined, as there is no polarization around the gauze, the solution flowing freely through it and preventing any concentration or dilution.

S. Skowronski brought out the fact that this box was an ideal means for determining the conductivity or resistivity of a solution.

George B. Hogaboom of the Hanson & Van Winkle Company, Newark, N. J., read a paper on "Anode Corrosion." Mr. Hogaboom explained that high purity anodes corrode with difficulty, therefore requiring the use of addition agents. Nickel in sulphate solution requires chloride or acetic acid, etc. Nickel chloride is useful in hot solutions; sodium chloride for high current densities and ammonium chloride is probably the most generally useful agent.

Mr. Hogaboom described some work he had done using ammonium chloride in a sulphate solution. He gave figures showing that by keeping up the chloride content of a solution of 350 gallons which carried 1½ ounces of ammonium chloride per gallon and three ounces of metallic nickel per gallon, the consumption of nickel salts was brought down to small proportions of that originally used, by the improved corrosion of anodes.

S. Skowronski, of the Raritan Copper Works, Raritan, N. J., delivered a short talk on copper before showing a moving picture of the extraction, refining and manufacture of this metal, from mine to consumer.

Horace Smith of the Newark Branch extended a strong invitation to those present and all those interested in the society to attend the 1926 convention in Newark. This convention is to be held in Salaam Temple, Newark. As many as 25 or 30 exhibits are expected and a strong educational program has been arranged, visits to plating shops to be included in the activities.

In the evening the banquet was held, which a large number of visitors and members attended. Music was provided by an excellent orchestra and attractive souvenirs were distributed to ladies and gentlemen present. The seventeenth annual banquet and Founders' Day celebration was a decided success.

Selection of Fuel for the Heat-Treatment of Metal

An Abstract of a Bulletin from the W. S. Rockwell Co., New York

Selection of a suitable fuel, or electricity, for heat-treatment processes should be made with appreciation of the fact that the value of the result sought is to be measured by the quality and over-all cost of the finished product; not merely by the price or consumption of fuel or electricity, temperature record, heat balance, or some such incidental phase of the heat-treatment process as a whole.

The real problem, from the manufacturer's point of view, is that of producing a quality product at low cost, and the use of such form of fuel, or electricity, and such character of equipment for heating, cooling and handling, as will produce this result under his specific manufacturing conditions.

Any method of selection, based on abstract comparison of different forms of fuel, or electricity, and the claimed advantages of one over the other is inaccurate, misleading and out of date in fact, though apparently not in effect. Each form has its field of usefulness, as well as its limitations, all of which vary with the nature of the heating process, the type of furnace or other heating appliance, the method of operation, the manufacturing requirements, the plant conditions, and many other factors, any one of which may influence the choice under specific conditions.

The situation is very confusing to one concerned with the selection of industrial heating equipment properly adapted to his specific requirements. He is confronted with the conflicting claims of enthusiastic advocates of many different forms of fuel, electricity, furnace material or heating apparatus; and with evidence or opinion in tales of success or failure that may be far removed from proof or fact.

In considering solid fuels, he learns something of the claimed relation of hand-firing to stoker-firing of different forms of bituminous or anthracite coal, and of powdered coal.

Consideration of fuel oil raises a question as to the suitability of heavy oil or light oil. A choice is made difficult by conflicting claims for dozens of different types of so-called "oil burners" designed for steam, high or low pressure air (or both), and of an equally great variety designed to atomize mechanically.

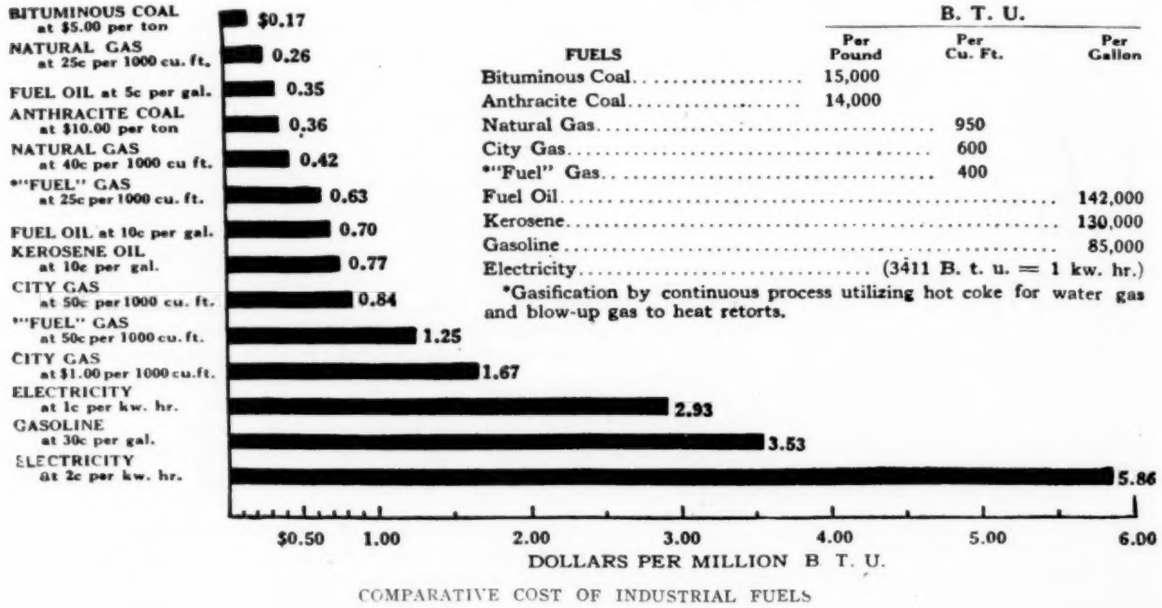
He is informed that gas is the best fuel and wonders if it should be city gas, natural gas, water gas, oil gas, mixed gas, hot or cold producer gas, or some other form of gas.

A desire to avoid the difficulties with fuel leads to thought of electricity, and of the possibilities with either the arc, induction, or resistance methods; of resistors in different forms of refractory or metallic material; of round wires, or flat wires, that may be exposed or muffled; of cast or rolled metallic units; of high and low frequency; of the possibilities of automatic temperature control with fuel or electricity, and so on, ad inf.

When proper study of the problem as a whole discloses the fact that the economic relation of the many different forms of fuel or electricity continually varies with an unending and ever-changing variety of furnace designs, he may conclude that when no one knows, every one has a right to guess. So, be makes his guess, assuming that they are all cheap at any price; that each is better or a great deal worse than the other, and that each has its earnest advocates of the type that made Alabama famous.

A good move, in the direction of improvement, would be to cultivate the thought that many of the prevailing ideas, and much of the discussion, is really beside the point at issue; that no one form of fuel, food, or medicine, is suitable for the general run of requirements; that we are more concerned with the practical problem of heat-treatment than with the theoretical condition established by the usual discussions of the so-called "fuel problem."

We can well do with less useless discussion about fuels, and more constructive thought of the underlying principles affecting the heating, cooling and handling of products to be heat-treated, and comfort of the operatives, along common-sense lines.



Assumed Thermal Value

FUELS	B. T. U. Per Pound	B. T. U. Per Cu. Ft.	B. T. U. Per Gallon
Bituminous Coal	15,000		
Anthracite Coal	14,000		
Natural Gas		950	
City Gas		600	
*"Fuel" Gas		400	
Fuel Oil			142,000
Kerosene			130,000
Gasoline			85,000
Electricity		(3411 B. t. u. = 1 kw. hr.)	

*Gasification by continuous process utilizing hot coke for water gas and blow-up gas to heat retorts.

COMPARATIVE COST OF INDUSTRIAL FUELS

THE METAL INDUSTRY

With Which Are Incorporated

THE ALUMINUM WORLD, COPPER and BRASS, THE BRASS FOUNDER and FINISHER
THE ELECTRO-PLATERS' REVIEW

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Contents

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EDITORIAL

INSTITUTE OF METALS MEETING

Several important and pressing problems are confronting metallurgists engaged with non-ferrous metals, one of the most important being the effect of various gases in metals. This problem was discussed at two sessions of the Institute of Metals meeting which was held in New York, February 15-18, 1926, and a comprehensive group of papers devoted to the action of reducing gases on copper. A full report of this meeting will be found, beginning on page 95 of this issue. Altogether thanks are due to Mr. Skowronski, Chairman of the Papers Committee for one of the best meetings of the Institute ever held.

Among the more noteworthy papers was a report on The Lead-Antimony System and Hardening of Lead Alloys by Dean, Zickrick and Nix, showing the existence of marked age hardening in lead-antimony alloys and susceptibility to heat treatment. Archer and Kempf reported on the modification of Sand Cast Aluminum-Silicon Alloys by the addition of sodium in the melt shortly before casting. Pilling and Halliwell aroused considerable discussion by stating that tin and lead could be present in copper for electrical conductors, up to .03 per cent total, without impairing the conductivity and ductility of the metal for practical purposes. Skowronski and Bassett disagreed with them placing the limit of lead content at .0075 and .005 per cent respectively.

The session presided over by Mr. Skowronski on gases in copper was full of interest. Perhaps more discussion could have been held, but many of those present felt that their own work had not gone far enough to permit them to express definite opinions. It seemed agreed however, that reducing gases were among the most important causes of the embrittlement of copper. According to Miss Leister of the General Electric Company ". . . . the most important cause of the embrittlement of ordinary commercial copper is the reduction of cuprous oxide which exists either in solid solution or on a finely divided state along the grain boundaries." Proper annealing will segregate these oxides, forcing them to coalesce, and thus improving ductility of the metal.

Considerable discussion ensued about oxides in copper and Dr. Hayward urged strongly the continued attack on the problem of eliminating all oxygen from copper.

Unquestionably a real step forward was taken in the knowledge of the action of copper under the attack of reducing gases, and methods of preventing embrittlement.

ALUMINUM AND POLITICS

Accompanied by a blare of trumpets, the white light of publicity has fallen upon aluminum. For a month past the light metal has been featured in almost every edition of the daily press. The Aluminum Company of America, the domestic producer, has been attacked from various angles, business, political and others, on the ground that it is a trust, and an illegal combination in restraint of trade. As THE METAL INDUSTRY, which is an outgrowth of THE ALUMINUM WORLD, has recorded the progress of aluminum since October 1894, it is fitting at this time for us to trace the events in this aluminum agitation.

In 1924 the Federal Trade Commission, after an investigation in response to complaints, reported that the Aluminum Company of America was acting in such a fashion as to restrain trade. The Commission reported its findings to the Department of Justice for action. Shortly afterward, the then Attorney-General Stone announced his conviction that the company had violated a court decree issued in 1912, by which the company was enjoined from certain practices in restraint of competition in the aluminum business. There was a pause in governmental action and in the meantime Mr. Stone was selected for the Supreme Court, and Mr. Sargent appointed in his place.

The matter rested in the Department of Justice for some time until it was brought up again by the Senate Judiciary Committee at a special inquiry. This Committee finally reported back to the Senate, the majority holding that the Aluminum Company was in contempt of court while the minority held that the charge was unwarranted. After both of these reports were presented to the Senate the matter was put to a vote and the minority report was upheld, 36 to 33. The Department of Justice then dropped the charges against the Aluminum Company on the ground that the investigations of the Federal Trade Commission were not proved or justified and as a result the actions against that company have ceased.

Mixed up with the charges were statements (which were made apparently for political effect) that Secretary of the Treasury Mellon and his brother Robert B. Mellon, a Pittsburgh banker, held a controlling interest in the Aluminum Company of America, but according to the findings of the Department of Justice,—"the combined holdings of A. W. Mellon and his brother R. B Mellon are far from constituting a control." The control of the company appears to rest with the Hall Estate of which Arthur V. Davis, president of the company, votes the shares of the Hall family. Other stockholders of prominence are as follows: Mrs. Alfred E. Hunt, widow of Alfred E. Hunt, one of the founders; her son, Roy A. Hunt; George Clapp, Arthur V. Davis, A. K. Laurie.

So much for the political, personal, and legal aspects of the case. From the industrial standpoint, the testimony at the hearing of the Senate Committee has brought forth the statement that the Aluminum Company of America controls the following companies and railroads:

Alton & Southern Railroad, East St. Louis, Mo.; Aluminum Company of Canada, Ltd.; Aluminum Com-

pany of Michigan; Aluminum Company of South America; Aluminum Cooking Utensil Company; Aluminum Ore Company of Pennsylvania.

Aluminum Seal Corporation of Pennsylvania; American Bauxite Company of Arkansas; American Body Company of Buffalo; Bandite & Northern Railroad of Arkansas; Boxite and Bede Company, Southern France; Scenic Rapids Transmission Company, with plants at Messina, N. Y.

Shute Carde Corporation of Canada; Damerara Bandite Company, Ltd., of Canada; Franklin Fluorspar Company, a Delaware Corporation; Knoxville Power Company, a Tennessee Corporation.

La de Marie Company, a Pennsylvania Corporation; Messina Terminal Railroad Company, Messina, N. Y.; Northern Aluminum Company, a British Corporation; Ogdensburg Street Railway Company, Ogdensburg, N. Y.; Pierson-Roeding Company.

Pine Grove Realty Company, a New York Corporation; Republic Mining and Manufacturing Company, a Georgia Corporation; The St. Lawrence Water Company, New York; The St. Lawrence River Power Company, New York; St. Lawrence Securities Company, New York; St. Lawrence Valley Power Company.

Several other companies, including coal mines, are also controlled by the corporation, in addition to large interests held in many European concerns.

The Aluminum Company is building a plant on the Saguenay river, Canada, which will employ a large force and maintain a good sized factory town. Construction is in full progress and it is expected that the plant will be in operation by next September. As noted in an editorial in our August 1925 issue, this plant will probably be used for export only, to permit the Aluminum Company to compete in foreign fields, benefitting by the low production costs outside of the United States and the preferential tariff of the British Empire.

PLATERS' RESEARCH PROJECT

In our December issue we published an editorial concerning the co-operative research project undertaken by The American Electro-Platers' Society in conjunction with The Bureau of Standards. It is their plan to get 200 manufacturers to contribute $50 each per year for three years. These funds would be held in trust by the American Electro-Platers Society and expended only for salaries and expenses of persons engaged in this work at the Bureau of Standards.

At the recent meeting of The New York Branch, reported on page 111 of this issue, a message was received from F. J. Hanlon, past president of the Society, who is in charge of this fund. It seems that $1,150 have already been pledged, and of this $50 was subscribed by the Chicago Branch itself.

The example of the Chicago Branch is obviously most commendable in every way. It serves to show that the platers themselves are behind this project not only verbally but financially. It is an added incentive to the manufacturers to join this project, when they see that the men who solicit their funds have themselves contributed.

The plan of the Society is now to have the individual members bring this project to the attention of their employers, urging them to subscribe. The example of the Chicago Branch is so striking, the amount required from the individual manufacturer ($50 per year for three years), is so small and the project so eminently worthwhile and soundly managed, that it should be only a matter of a few days time devoted to actual work before the 200 subscribers are obtained.

We again urge those of our readers who are interested in electro-plating to communicate at once with F. J. Hanlon, Chairman of the Research Committee, 216 North Jefferson Street, Chicago, Ill., and send in their subscriptions.

SAVING FUELS

A problem as old as industry itself and at the same time constantly new was discussed at the convention of the American Gas Association in Atlantic City, during the latter part of 1925. The gas companies and manufacturers of appliances and equipment thrashed out the question of saving the fuel supply of the country. This means of course, not only saving our natural resources but saving in fuel costs for individual users.

It is a truism that our natural resources of fuel are a "wasting asset," in other words they are constantly being depleted without being replaced. Coal presents no immediate dangers as the supply in sight is large enough to last for hundreds of years. Coal gas, being manufactured directly from coal can also be depended upon. Natural gas, however, is already waning and oil, although at the present moment in the position of having produced more than it can sell, is known to have a limited life, at least as far as wells in sight are concerned.

But coal has the inherent disadvantage of being less convenient to use than the other fuels. And convenience in the United States at least, is translated into labor costs. These, being so high, are constantly pressing manufacturers to use other fuels even though their supply may be comparatively limited.

Gas men are taking the position that manufactured gas is the logical fuel to use, since it is convenient and is not a drain upon a natural resource whose end is in sight. Costs are, of course, another question; they vary with the locality, the quantity used and the conditions under which they are applied. It is no longer possible to compare costs per B.T.U., since the element of labor has assumed such importance. Every cost problem must be worked out as a special case, subject to its own special conditions.

It is easy to sit back and predict new developments. When oil is gone we shall have oil shales to fall back upon, and if they are too expensive, improved distillation methods will bring them down. Gas will, of course, be with us as long as we have coal. In the meantime electric heating, with current supplied from hydro-electric stations and transmitted over long distances, is making great strides. What the ultimate fuel will be cannot even be guessed at, as no one can predict future inventions either in equipment or processes.

One of the striking features of the conditions in the United States at the present time is the fact that with oil, gas and electric adherents shouting as loudly as they can about their own advantages, the result has been not the increase of any one of these fields at the expense of others, but the increase of all of them. If we had to make a prediction of any kind, we should say that this situation is likely to continue for many years to come.

CORRESPONDENCE and DISCUSSION

Although we cordially invite criticisms and expressions of opinion in these columns, THE METAL INDUSTRY assumes no responsibility for statements made therein

ALUMINUM ANALYSES

To the Editor of THE METAL INDUSTRY:

We have noted with interest an article in your issue, Vol. 24, No. 2, February, 1926, entitled "The Applications of Metals" written by Mr. E. G. Jarvis of Buffalo, N. Y.

We have been particularly interested in Mr. Jarvis's remarks under the heading of aluminum. He states correctly that the three principal forms in which aluminum is sold are 99 per cent aluminum, 98/99 per cent aluminum and No. 12 alloy, but unless he is referring distinctly to remelted or secondary metal, I must disagree with some of his remarks.

In the first place, he states that the highest grade of aluminum obtainable is that which presumably analyzes 99.28 per cent. We believe that you will find that the principal producers of aluminum in the world are quite generally able to offer a guarantee 99.5 per cent metal, and some of them 99.8 per cent. Of course, the usual grade known as 99 per cent plus will average among different producers from 99.2 per cent to 99.4 per cent.

Under the remarks on 98/99 per cent aluminum Mr. Jarvis quotes an analysis which for virgin metal would be very extraordinary. In the first place, we know of no standard brand of 98/99 per cent metal which will run as low as .29 in iron, nor do we know of any brand which contains copper to the extent of .21 per cent, and it is furthermore a well-known fact that no virgin aluminum contains zinc.

Inasmuch as this article, so far as we have been able to note, is referring to the properties of several well-known alloys and metals in general, a reader would be fully justified in assuming that the information given is of general character, which would mean that that it would not refer to any particular product, and it is for this reasons that we draw the matter to your attention.

New York, February 11, 1926. W. S. HAMNETT, J. E. Dockendorf & Co., Inc.

To the Editor of THE METAL INDUSTRY:

If you will refer to my article, you will see that the analysis of 99 plus is headed "typical analysis," not extraordinary analysis, or unusual analysis, just an average analysis. Only yesterday I was in a place which buys aluminum from the Aluminum Company of America, and also other concerns, and they just had an analysis given them from the Aluminum Company of America of their 99 plus. The Aluminum Company of America themselves, stated their 99 plus to be as follows:

Manganese	.02
Copper	.14
Iron	.56
Silicon	.23
Aluminum	99.05
Zinc	none

Under the heading of 98-99 per cent aluminum, you will find that I also say "typical analysis," not mentioning any particular producer's name, but the typical analysis shown is that of the average analysis of a number of producers of ingots. There is a great deal of 98-99 aluminum on the market, containing .21 per cent of copper and in some instances more, and most of the 98-99 aluminum on the market made from virgin material contains certain quantities of zinc.

I see absolutely no reason why the article should be corrected because I was not quoting any special analysis but simply a typical average analysis of the various grades of aluminum, and if you will be kind enough to take any text book and check up the analysis shown, where you will find that the figures we gave were accurate and correct.

Buffalo, N. Y. ERNEST G. JARVIS, President,
Feb. 12, 1926. Niagara Falls Smelting & Refining Corporation.

PEELING NICKEL SOLUTION

To the Editor of THE METAL INDUSTRY:

In my last trip through Michigan, I ran into a job shop and to my surprise I found the copper solution down; also the nickel and silver. They informed me that a traveling salesman (with whom I am acquainted and I know him to be a good man), tested out the solution with litmus paper and advised them to add muriatic acid. They later discovered that the litmus paper had been exposed in the sunlight, etc., and it was no good. Since they claim to have added 2 gallons of aqua ammonia.

It strikes me that it was no wonder that the nickel would not stick, for he should have used carbonate of amonia, and even then one must never use either acid or ammonia, except just a little at a time until one gets results, I believe, however, that glacial acetic acid is much better than muriatic acid. Carbonate of amonia is very good to cut the acidity and bring the solution back to neutral. Yet when all is said and done, the best way is to work it out by boiling the solution. If one cannot boil it, one can at least get it good and warm. Then take some flat pieces of iron or steel, put hooks on them, get them good and clean, place them on your cathode rod, turn on the current full if possible, and let the iron or steel receive all of the acid.

Coldwater, Mich. ANDREW V. RE.
February 15, 1926.

CORRECTION

To the Editor of THE METAL INDUSTRY:

In your issue of January, 1926, on page 29, in my letter on Zirconium Aluminum Alloys, it was stated that certain test bars of an alloy containing 5 per cent of a 75 per cent iron and 25 per cent zirconium alloy (the balance aluminum) had a tensile strength of 3100 lbs.

This figure was in error. It should have been 31,000 lbs.

Asbury Park, N. J. E. D. GLEASON.
February 10, 1926.

A WORD OF THANKS

To the Editor of THE METAL INDUSTRY:

I am very grateful to you, for the information regarding my problems. I have been a reader of THE METAL INDUSTRY and other magazines for over two years and I must say that I consider THE METAL INDUSTRY the best in help and knowledge.

I also wish to thank Mr. Proctor for his assistance.

Shelton, Conn. RALPH COLTER.
January 18, 1926.

TECHNICAL PAPERS

Thermal Expansion of Tungsten. By Peter Hidnert, and W. T. Sweeney. Scientific paper of the Bureau of Standards, No. 515.

This paper gives the results of an investigation on the thermal expansion of tungsten (99.98 per cent) over various temperature ranges between—100 and 500°C. A summary of available data obtained by previous observers on the thermal expansion of tungsten is included. The expansion of tungsten is given by the following empirical equation:

$$L_t = L_o [1 + (4.28\ t + 0.00058\ t^2)\ 10^{-6}]$$

where L_t represents the length of the metal at any temperature t between—105 and 502° C., and L_o the length at O°C. Average coefficients of expansion for various temperature ranges are given in a table.

Inductive Heating, by E. F. Northrup. A Paper presented at a meeting of the Franklin Institute, Philadelphia, Pa., on December 3, 1925. Printed in the Journal of that Institute for February, 1926.

Dr. Northrup traced the history of induction furnaces from the original idea of Moissan to the present, explaining the principles of modern example, the Ajax-Northrup furnace. He concluded with the following predictions:

(1) The melting efficiency of furnaces increases rather than decreases with size and no limination is in sight for the size of furnace which may be practically made and used.

(2) Generators of the necessary current can be built in as large units as may be required and their cost per kw. rating falls off with their increase in size.

(3) The crucible-type of furnace is restored to electric melting which makes the high-frequency inductive method the friend of the crucible manufacturer.

(4) The efficiency of melting by ironless induction compares very favorably with the best electric furnaces of other types.

(5) For the first time in the history of fuel or electric melting of ferrous materials does it become possible and feasible to melt large quantities of metal in crucibles and without the presence of any carbon and with perfect control of chemical composition and speed of melting.

(6) The circuit which supplies the high-frequency power operates at substantially unity power factor and the load on the motor which drives the generator is very steady, of high or unity power factor and is in all respects the ideal load from the viewpoint of the station man.

(7) The reactive component of the power is taken care of with condensers which, in the way used, are inherently much less costly than generators made of sufficient excess size to accomplish the same purpose.

Metallurgy of Quicksilver, by L. H. Duschatz and C. N. Schutte. Bureau of Mines, Bulletin 222. Price 30c. Obtainable from Superintendent of Documents, Washington, D. C.

Because of its small commercial importance and the lack of a stable market and price for the metal, the quicksilver industry, as a whole, has not had the benefit of the same metallurgical and business direction that has been given to the winning of the major metals. The unique relation of mercury to national health because of its use in certain drugs, and to national security because of the need for quicksilver fulminate for defensive purposes, and the indispensability of the metal and its compounds in science and industry, due to the fact that there are no substitutes for it seemed to justify investigation of the quicksilver industry by the Bureau of Mines.

The main conclusions to be drawn from the experimental work performed by the Bureau of Mines may be summarized as follows:

In the direct-furnace treatment of quicksilver ores the major problem in the extraction of quicksilver has been solved. Methods are available whereby low-grade ore can be treated with a remarkably high recovery and at low cost in view of the small scale of operations at most plants. It does not follow that present practice at all or even at the majority of the quicksilver reduction works in this country has reached the highest possible point of efficiency. Improvements can be made at many plants mainly by correcting minor defects rather than by making fundamental changes in processes.

New Books

Oil Burner Testing. Published by the American Oil Burner Association, New York. Size 8½ in. x 11 in. 28 pages. Price, 75 cents.

This is a bulletin, thoroughly covering the methods and procedure in oil burner testing wherever the burners are fired under boilers or in warm air heating plants. The bulletin discusses such theoretical considerations as are needed for the practical application of the methods and procedure given, which apply for both industrial and domestic burners. One of the principal purposes of preparing the bulletin was to provide under one cover all the important tables and formulae needed in testing burners, so that those in charge of the test need not suffer the usual annoyance and loss of time due to having to use a number of handbooks or references.

Emphasis is laid on the heat balance method of test for domestic burners. By this method, with simple apparatus and few observations, the operating efficiency of an oil burner can be learned quickly with a sufficient degree of accuracy for most purposes, the bulletin states. A chart for quick determination of losses in oil combustion which will prove particularly useful is included in this manual of testing.

MacRae's Blue Book, Consolidated with Hendrick's Commercial Register.

MacRae's Blue Book Company, Chicago, Ill., having acquired control of Hendrick's Commercial Register, will, upon its next edition, issue a general directory, known as "MacRae's Blue Book, Consolidated with Hendrick's Commercial Register."

The consolidated publication will blanket not only the steam and electric railroad field, but also the worth-while industries of America, public utilities, chambers of commerce, etc.

It is not intended that the consolidated book shall be combination of mailing lists or "a complete directory of American manufacturers," but it will give to the leading buyers of America a comprehensive list of manufacturers from whom they can obtain competitive and responsible quotations.

A Bibliography of Bibliographies on Chemistry and Chemical Technology, 1900-1924, by Clarence J. West and D. D. Berolzeimer. Published by the National Research Council, Washington, D. C., as their Bulletin No. 50. 308 pages. Price, $2.50.

This work is composed of the following sections: General Bibliographies, Abstract Journals and Year-Books, General Indexes of Serials, Biblographies of Special Subjects and Personal Bibliographies. As the title indicates, the work is a compilation of bibliographies published as separates, or at the end of books or magazine articles, or as footnotes to the same, on the numerous aspects of pure and applied chemistry. Each entry gives name of author or compiler, title and place of publication. The majority of the entries state the number of references, thus giving an indication of the completeness of the particular bibliography. The entries are classified under the proper subject-headings, alphabetically arranged. The duplication of individual entries has been largely avoided by the liberal use of cross-references. An approximate analysis shows that there are about 2,400 subject-headings, 7,500 author entries and a total of 10,000 individual bibliographies. Although no claim is made for the completeness of the compilation, it is believed that the work will furnish a convenient starting point for any bibliographic search.

International Critical Tables of Numerical Data of Physics, Chemistry and Technology. Published by the National Research Council, Washington, D. C. Five volumes, 8½ in. x 11 in. each, including in all, 2,500 pages. Price $35 per set, until the appearance of Vol. 1, early in 1926. After that the price will be $60 per set.

The material contained in International Critical Tables has been collected and critically evaluated by some 300 cooperating experts, including chemists, physicists and engineers of the United States, Canada, Great Britain, Belgium, France, Italy, Austria, Germany, Denmark, Switzerland, Holland, Australia and Japan.

The scope of the material collected covers all available information of value concerning the physical properties and numerical characteristics of (a) pure substances, (b) mixtures of definite composition, (c) the important classes of industrial materials, (d) many natural materials and products, and (e) selected data for selected bodies or systems, such as the earth and its main physical subdivisions and the solar and stellar systems. Publications of the world in all languages have been combed for data and much unpublished information has also been collected.

In addition to their wide scope, the tables will contain many novel features of arrangement.

SHOP PROBLEMS

IN THIS DEPARTMENT WE ANSWER QUESTIONS RELATING TO SHOP PRACTICE

ACID COPPER SOLUTION

Q.—I am going to make an acid copper and want to know if molasses is as good as dextrine in an acid copper solution; and if 175 pounds of copper sulphate are enough for one hundred gallons. My tank holds 350 gallons and the formula I have calls for 175 lbs. per 100 gallons.

A.—The following formula can be used successfully for acid copper deposits.

Water	1 gallon
Copper sulphate	1¾ lbs.
Sulphuric acid 66°	4 to 8 ozs.

Black molasses or yellow dextrine ⅓ oz. maximum. Try ¼ oz. first.

Solution should be agitated, maintained at 80 deg. F., at 1 to 2 volts. Use plenty of anode surface of soft sheet copper, not less than ⅛ thick.—C. H. P. Problem 3,494.

BLACK ON GOLD

Q.—Kindly advise a white gold antique solution, or some good black soft enamel or black lacquer, to paint on the scrolls of rings.

A.—It is our opinion that for your purpose either dead black Jap-a-Lac or a japan black will answer. Apply the material with a soft pencil brush, then let the articles stand until partly dry. Wipe off the excess color with a cloth, moistened with linseed oil and turpentine, equal parts. We shall be pleased to send you information covering the production of antique black on white gold, if you desire it, but it requires more manipulation to produce the same results.—C. H. P. Problem 3,495

BRIGHT DIPPING ALUMINUM

Q.—If possible, will you kindly advise the solution used for brightening aluminum by dipping method?

A.—You cannot produce a bright lustre on aluminum by acid dipping, the same as can be produced on copper, bronze or brass. The color is termed, satin or matte finish. To produce such a finish, the aluminum articles should be free from grease, best removed by gasoline, benzine or hot kerosene oil. After such cleansing, the articles should be immersed in any good commercial cleaner advertised in THE METAL INDUSTRY.

The proportions of any such cleaner should be about 6 ozs. per gallon of water, heated to 200° F. Immerse the aluminum articles in the cleaner for two minutes, or until they darken perceptibly, then remove them and wash thoroughly in cold water. Immerse in the following acid dip for about half a minute. Nitric acid 38°, 2 gallons; sulphuric acid 66°, 1 gallon. Drain the articles thoroughly after acid dipping, then wash in cold and boiling water and dry out in maplewood sawdust.—C. H. P. Problem 3,496.

BRITTLE NICKEL SOLUTION

Q.—Some time ago our nickel solutions became contaminated with copper, presumably by using the same utensils for boiling nickel salts that we used to make an acid copper solution. So on advice of our supply house, we threw it away and put in a new one, using formula on page 1 of Platers' Wrinkles, for heavy white deposits on gray iron or steel. We made the solution exactly as per formula and are getting very good results, except that the nickel seems to be very brittle. Also it seems to plate bright, although we did not add nickel fluoride. The way we handle our work is to plate a while in nickel, then in copper (acid or cyanide), then buff and plate again in nickel. Our work is mostly on auto parts so we thought this solution would be best. We have used solution about 2 or 3 weeks. Can you tell us how to make it plate a heavy deposit that is not brittle?

A.—Apparently your trouble is due to hydrogen gas that forms on the articles to be plated as soon as put into solution. To prevent the hydrogen layer when the articles are first put in the nickel solution, lift them up and down at least twice before making electric contact with the work pole.

As a precautionary measure, after cleansing the product to be nickel plated, brush down with a plastic lime solution made up of slacked lime and water; just a little cyanide may be added to the water.

If the nickel then shows brittleness, add 1/15 oz. sodium perborate to each gallon of solution, or 1 lb. to 250 gallons. First dissolve the material in 4 gallons of water; stir thoroughly and then add muriatic acid until it shows just a trace of acid to blue litmus paper test. Stir thoroughly into your nickel solution. —C. H. P. Problem 3,497.

CADMIUM PLATING PATENT

To the Editor of THE METAL INDUSTRY:

We wish to call your attention to a question and answer regarding cadmium plating in your February issue at the bottom of page 77 and top of page 78, and advise you that our U. S. Patents No. 1,564,413 and 1,564,414, copies of which are attached, cover the answer given. If any of your readers or inquirers follow the directions given, they will be infringing the said patents and you will, of course, have contributed toward said infringement.

Last summer, you published practically the same thing in the same column and we called your attention to this. At that time our patents had not been issued.

We would suggest that in giving such advices you advise your readers that same is covered by U. S. Patents, and we also suggest that in your next issue you publish the fact that said cadmium solution is covered by U. S. Patents of The Grasselli Chemical Company.

Cleveland, Ohio. THE GRASSELLI CHEMICAL COMPANY.
February 20, 1926.

FINISHING BRASS ANGLES

Q.—We have cast brass angle pieces which have to have a very fine nickel polish and I find that grinding and polishing are very costly operations. Do you think a milling machine operation would be practicable; or have you any suggestions as to setting up wheels or using different compounds in the polishing room?

A.—It is difficult to give data covering the use of emery wheels to cut down the cost of labor of polishing cast brass angles. We believe, however, that you have the correct idea in advocating the use of a milling machine operation to cut down costs and reduce time of finishing.

The edges of a good number of pieces could be milled at one time for nesting them in each other after the insides had been first milled. If a good smooth milled finish results, all that would be necessary would be to cut down with Tripoli composition and then color buff to a finish.—C. H. P. Problem 3,498.

MERCURY DIP

Q.—Can you give me a formula for making a mercury dip? Such as we have made, makes the brass so brittle that it breaks under very light pressure.

A.—When a mercury dip is used as an amalgamating solution for brass, to prevent the non-adherence of the silver deposit, it is always advisable to use a weak solution; otherwise the mercury will combine with the zinc in the brass and produce cracks, as you have learned by experience.

You can prevent the local action of the mercury upon the zinc in the brass by first copper plating the brass for a minute or so in a cyanide copper solution, preferably warm. Prepare the mercury dip as follows: Water 1 gallon; sodium cyanide 96-98° 6 ozs.; yellow oxide of mercury ⅛ oz.

If this amount of mercury whitens the copper deposit, or produces a whitish pink tone, it will be satisfactory. If not, add 1/16 oz. more, as may be advisable.—C. H. P. Problem 3,499.

OXIDIZING SILVER

Q.—We have tried several silver oxidizing baths with but little success, and are writing to you for assistance in this problem.

A.—It is not difficult to produce an oxidized silver finish. The first requisite for success is to be sure that you deposit enough silver upon the articles to withstand the action of the oxidizing solution which reduces some silver from the deposit, due to the formation of the silver sulphide, or "oxide," as it is commonly termed.

For successful silver plating solution, see Platers' Wrinkles. It is advisable to nickel plate articles first before silver plating as this method saves silver. The usual silver strike solution, however, will have to be used to strike the nickel plated surface quickly before regular silver plating.

After silver plating, immerse the silver plated articles in a solution prepared with water 1 gallon; polysulphide 1 oz.; aqua ammonia 26° ¼ oz.; temp. 200° F. The silver will immediately turn a blue-black tone. Then remove quickly, wash in cold and boiling waters, and dry out in sawdust. Scratch brush the surface to bring up a finish to the oxidized surface. Use a soft steel wire or brass wire scratch brush.

Afterwards brush down or scour down, to remove the oxide from the high lights, with powdered silica or fine pumice stone mixed with water and a cheap wheat flour. The scouring wheels may be Tampico or regular small buffing wheels made up of Canton flannel. Keep the wheels wet with water. After scouring down, wash and dry the articles; then lacquer with a silver or brush brass lacquer.—C. H. P. Problem 3,500.

PLATING ALUMINUM

Q.—While we have been bronze plating aluminum for some time we have not obtained the results that could be called entirely satisfactory, and we would appreciate very much if you would give us the information asked for. Also kindly advise if it is possible to obtain a better bronze plating in case nickel is applied first. We have tried this at various times but find that in most cases the surface tension is apparently great enough to cause the deposit to flake from the aluminum.

A.—There are several methods by which bronze can be plated on aluminum, nickel being one of the basic factors. In our experiments at various times, we have used a zinc cyanide solution as the factor to give a deposit of zinc on the aluminum. After the zinc is deposited, then copper, bronze or brass can readily be deposited upon its surface in any good type of cyanide solutions of these metals.

The following solution can be used for the zinc deposit: Water 1 gallon; sodium cyanide 4 ozs.; zinc cyanide 4 ozs.; caustic potash 2 ozs.; aqua ammonia 26° 1 oz. Temperature 120° to 140° F., at 5 to 6 volts. The aluminum should be be cleansed as usual by removing excess grease, etc., resulting from polishing, etc., with benzine or gasoline or with heated kerosene.

Follow up by regular cleansing in any good solution prepared from commercial cleaners. Follow up the alkaline cleaning and washing by an immersion in the acid passive dip consisting of nitric acid 38° 2 parts; sulphuric acid 1 part. To every gallon of the mixed acids, add 1 oz. of perchloride of iron. Immerse the cleansed aluminum in the acid dip for a moment or two, then remove, wash quickly in clean cold water and plate as outlined. —C. H. P. Problem 3,501.

PLATING ON COMPOSITION METAL

Q.—We are manufacturing bronze castings which are used for handrails. The mixture which we use is composed of 85% copper, 5% tin, 5% zinc and 5% lead. Our customer has trouble with the nickel peeling off, and the plater claims that the proper mixture is not being used. We would be pleased to know what mixture of metals we should use if the one we are now using is not satisfactory or what might cause this trouble.

A.—Your plater's contention is correct to a certain extent. The trouble in nickel plating this alloy is primarily because the cleansers that are high in caustic soda cause an oxidation of the polished bronze surface. Small amounts of tin and lead are attacked and form oxides.

The cause of the nickel peeling, the non-adherence of the nickel to this oxide. Cyanide dips do not remove it. A weak muriatic acid dip could be used which would dissolve the oxide. It would be necessary then to give the articles a second quick immersion in the cleaning solution, re-wash and follow up with the cyanide dip. Re-wash and nickel plate. It may be necessary to brush down the surface of the bronze castings (after cleansing) with freshly slacked lime made into a plastic paste with water. You might try out the following cleaner for the bronze metal. Water, 1 gallon; soda ash, 58%, 4 ozs.; tri-sodium phosphate, 4 ozs.; sodium cyanide, 96-98% ¼ oz. This cleanser should clean the bronze metal surface without oxidation.—C. H. P. Problem 3,502.

PLATING CHROMIUM

Q.—Could you refer me to the source of information on deposition, electrically or chemically, of chromium. I read recently of the use of this in place of lacquer on silver to permanently preserve the surface from corrosion and loss of lustre. Would like to know the practice commonly in use.

A.—We refer you to the articles published in THE METAL INDUSTRY for November and December, 1925, and February and March, 1926.

Lacquering of a metal surface for protection against oxidation is one thing, but depositing chromium is decidedly another.—C. H. P. Problem 3,503.

SOAP IN NICKEL SOLUTION

Q.—I would appreciate your kindness if you would tell me of some formula to remove soap from nickel solution or some suggestion that may help to overcome the trouble. The solution is a bright nickel, and it has been working just fine, but somehow a piece of hand soap got into the work and I did not see it until it was in the tank about 30 minutes and the work was spoiled.

A.—About the only way to remove the soap that has gotten into your nickel solution would be to heat it as hot as possible in the tank with a steam coil.

The solution would absorb any free alkali in the soap, and upon cooling, the fatty matter would settle out upon the top of the solution. It would then be necessary to add a small amount of free acid per gallon of solution; 1/16 oz. of muriatic acid per gallon of solution will be ample.

You might try the following additions to a 10-gallon test solution, cold, or at 80 deg. F., before heating, and see if satisfactory results follow.

Sal-ammoniac 1 oz.
Muriatic acid 1/16 to ⅛ oz. } Per gallon of solution

If the results are satisfactory, then omit the heating of the solution.—C. H. P. Problem 3,504.

TIN PLATE BRONZING

Q.—Can you give me any information on bronzing? We make a display fixture out of tin plate and want to finish it a scratch or brush brass, using a spraying outfit or paint gun.

Also, bronze powders are priced from 75c to $2.25 per pound but they all look very much alike. How do they differ?

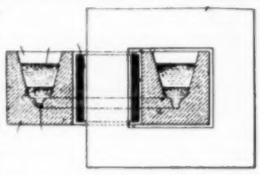
A.—One of the largest manufacturers of windows curtain fixtures produces a brush or satin finish brass upon steel by spraying a satin finish brass colored bronze powder upon cleaned bare steel. So it should not be difficult to produce similar results upon a sheet tin surface, providing the surface is clean. We advise you to get in touch with any of the lacquer manufacturers advertising in THE METAL INDUSTRY. They will give you all the necessary data to produce the finish you want. The manufacturers of spraying apparatus will also be able to advise you regarding the necessary equipment.

There are various grades of bronze powders; the brass colored bronze powders are the most expensive, and you will have to decide which grade to use. The cleansing of tin plate surfaces is best accomplished by the use of benzole or gasoline. A moment's immersion will usually cleanse any grease that is upon the surface of the tin from fabrication, then dry out in sawdust although the tin could dry by itself. If alkaline cleansing is used, any mild commercial cleaner could be used, or a cleaner composed as follows: Water, 1 gallon; tri-sodium phosphate, 2 to 4 ozs.; soda ash, 58%, 2 to 4 ozs.; temperature 180° to 200° F. Wash thoroughly in cold and boiling waters. Afterwards drain well and dry out by heat.—C. H. P. Problem 3,505.

PATENTS

A REVIEW OF CURRENT PATENTS OF INTEREST

1,564,800. December 8, 1925. **Electric Furnace.** Magnus Unger, Pittsfield, Mass., assignor to General Electric Company, a corporation of New York.



An electric furnace comprising a crucible providing a relatively wide channel in which the charge is heated by current passed therethrough, said channel including a relatively deep narrow groove at the bottom for increasing the hydrostatic head of molten metal.

1,565,216. December 8, 1925. **Electroplated Stereotype Plate or Nickel-Plated Printing Plate and Process of Making the Same.** Christian N. Smith, Elgin, Ill., assignor of one-half to William P. Toping, Elgin, Ill.

The process of making electroplated stereotype plates which comprises providing a molded stereotype plate body to be plated, submitting the surface of the printing side of said stereotype plate body to the chemical action of a solution containing corrosive sublimate and water, thereby removing foreign substances from the surface of the plate body and producing a lusterless surface on the printing side of said plate body, and then electrolytically depositing a plating on said lusterless surface.

1,565,358. December 15, 1925. **Alloy for Electrical Contacts.** Leland A. Gardner, East Orange, N. J., assignor to American Telephone and Telegraph Company, a corporation of New York.

As an electric contact material consisting of a major part of fine gold, a lesser part of nickel, a still lesser part or zinc, and a small quantity of copper.

1,565,420. December 15, 1925. **Method of Treating Coated Materials.** Edgar Cornell, Jr., Pittsburgh, Pa., assignor to Westinghouse Electric & Manufacturing Company, a corporation of Pennsylvania.

A method of treating zinc coated materials which comprises heating the same to a temperature sufficient to change the grain structure of the zinc and then working the material.

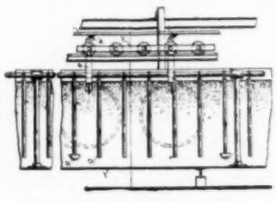
1,565,495. December 15, 1925. **Process By Which Aluminum Metal and Its Alloys May Be Applied to Ferrous Metal.** Carl W. Pfeil, Greenbank, Wash.

The process of applying an aluminum coating to a base metal which consists in very finely dividing the aluminum in a bath of an air-excluding film-producing material, applying the compound thus formed to the metal to be coated and heating.

1,565,496. December 15, 1925. **Process for Making and Combining Corrode-Resisting Metals.** Carl W. Pfeil, Greenbank, Wash.

A process of providing a corrode-resisting metallic combination for composite ferrous metals, which consists in heating a tin-coated ferrous metal until the tin melts and mixing finely divided aluminum with the molten tin until it can absorb no more.

1,565,683. December 15, 1925. **Method and Apparatus for Electroplating.** Joseph G. Swain, Akron, Ohio, assignor to The Firestone Steel Products Company, Akron, Ohio.



In a process of electroplating the steps of subjecting the article to be electroplated to an electrolyte charged simultaneously from anodes of zinc and metallic mercury.

1,566,078. December 15, 1925 **Refining Lead.** Philip W. Davis, Cambridge, Mass.

The method of refining lead which consists in exposing lead alloys in molten condition to the action of molten litharge by causing the two materials to be exposed to each other in bodies of small dimensions.

1,566,406. December 22, 1925. **Method of Producing an Alloy of Copper.** Charles Kazemer, Cleveland, Ohio, assignor of one-third to William A. Jones, Cleveland, Ohio.

A method of producing an alloy which consists in the step of melting copper with glass, reducing the melt to sheets, reducing the sheets in thickness by pressure, re-melting the reduced sheets with an admixture of silver and glass, reducing the melt to a sheet, reducing the thickness of the sheet by pressure, and then reducing said sheets to a workable form.

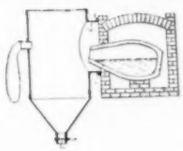
1,566,420. December 22, 1925. **Mold Composition.** Aladar Pacz, Cleveland, Ohio.

A composition of matter comprising metallic silicon containing material and a binding material, both in finely divided form, and intimately mixed with each other.

1,566,749. December 22, 1925. **Apparatus for Use in Hot Galvanizing and the Like.** Wallace G. Imhoff, Pittsburgh, Pa., assignor to Warren S. Smith, New York, N. Y.

In apparatus for use in hot galvanizing and the like, an article to be brought into contact with molten zinc comprising a metallic body, said body having a coating of an enamel comprising a complex aluminum borosilicate as the basis thereof on the surface of the body which comes into contact with the molten zinc to provide a heat conducting medium for protecting the body of the article from the solvent action of the molten zinc.

1,566,913. December 22, 1925. **Apparatus for Manufacturing Metal Dust.** Minton H. Newell, San Francisco, Cal., assignor, by mesne assignments, to The Alloys Company, San Francisco, Cal.



In an apparatus for manufacturing metal dust, a condensing chamber provided with an aperture and means for retarding the inflow of air through said aperture, said chamber being otherwise substantially air tight.

1,566,984. December 22, 1925. **Electroplating Method and Electroplated Articles.** Robert Jay Shoemaker, Chicago, Ill.

Improvement in the method of electroplating iron articles which consists in covering the surface of the article to be plated with a permanently adherent film of mercury and a metal with which mercury will amalgamate and thereafter electroplating said surface.

1,567,066. December 29, 1925. **Nickel-Copper Alloy.** Justus W. Lehr, Baltimore, Md., assignor, by mesne assignments, to U. S. Industrial Alcohol Company, of West Virginia.

A non-corrodible alloy containing nickel 20 to 40 per cent, tin 1 to 6 per cent, lead 1 to 8 per cent, the remainder copper, and containing no zinc.

1,567,219. December 29, 1925. **Metal-Melting Method.** Wister C. Williams, Decatur, Ill., assignar to McLaughlin Coal Reduction Company, Decatur, Ill.

Method of melting metal which consists in subjecting the metal in an open container arranged in a confined space to the heat of a pulverized fuel flame directed circularly around said container and issuing out of the space above the container and baffled at its outlet so that it deposits incombustibles on the metal in the container.

CASH REGISTER SUIT

The Court of Appeals upheld the right of the Remington Arms Company to cash register patents claimed by the National Cash Register Company. The decision, which is final, establishes the Remington Arms Company as the chief competitor of the National Cash Register Company.

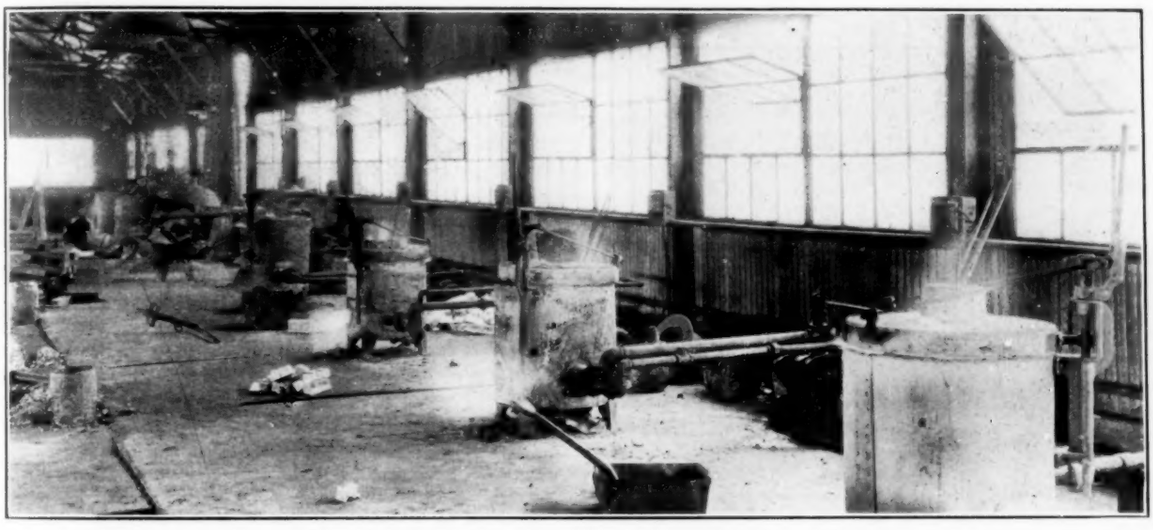
The National Cash Register Company had sought to compel the Remington Arms Company to make an assignment of cash register patents covering inventions of Frederick F. Fuller, who left the National Cash Register Company to take employment with the Remington Arms Company. Mr. Fuller is known as the oldest cash register inventor in the United States.

EQUIPMENT

NEW AND USEFUL DEVICES, MACHINERY AND SUPPLIES OF INTEREST

A MODERN METALLURGICAL PLANT

The illustrations below show the new plant of the Niagara Falls Smelting and Refining Corporation at 2204-2214 Elmwood Avenue, Buffalo, N. Y. This company was incorporated in May, 1923, and its growing business made it necessary to build the new plant, which consists of an office building 25'x50', one story high, frame construction; two steel buildings, one 160'x60' with one story, height 24' and the other 80'x40', one story high. Three other buildings one 140'x30', two stories high, one 60'x60' and another 40'x30', one story high. The company devotes its attention to the manufacture of special alloys such as silicon-copper, phosphor-copper, manganese-copper, copper-aluminum, silicon-aluminum, manganese-aluminum, ferro-nickel, ferro-chrome-nickel, ferro-deoxidizer, nickel-copper alloys, nickel silver, silicon, phosphor and manganese bronze; also, all standard aluminum and brass mixtures.



VIEW OF SPECIAL ALLOY DEPARTMENT

This new plant is said to have been operating at capacity since it was built. In all, 11 furnaces are operating on special alloys as well as a brass and aluminum plant. The capacity is 3 tons of special alloys, 7 tons of aluminum and 5 tons of brass per day. The plant has an overhead tramrail system for conveying the metal from one department to another, shears, magnetic separators, etc.

Every furnace operates as a unit by itself, having a direct connected motor and blower, and is not dependent upon any other part of the plant for operation. A ventilating system takes care of all fumes and smoke from the smelting operations and is of the most modern construction, built of Truscon steel, Fenestra Sash and concrete constructions.

The plant has metallurgical and chemical laboratories devoted to control of the plant, purchase of raw material, and offers a consulting and analytical service free to its customers. This department will analyze samples, gather information and issue reports on any metallurgical problem free of charge.

BATTERY OF BRASS MELTING FURNACES

This new plant is the work of Ernest G. Jarvis, metallurgical engineer, and president of the company, who founded the business and has been its general manager since incorporation. Mr. Jarvis was formerly chemist and metallurgist for the Aterite Company of New York, general superintendent of foundries and rolling mills for McNab & Harlin Manufacturing Company at Paterson, N. J. He was also metallurgist for the Canadian Inspection Department during the first two years of the war. He was chief chemist and metallurgist for the Dominion Foundry and Steel Company of Canada and has been employed by Steel Company of Canada, Canadian Westinghouse Company, International Harvester Corporation, and a number of other companies. Mr. Jarvis holds a number of patents on special alloys, in the United States and abroad, and was at one time a director of the New Jersey Chemical Society, of which he is still a member. He is a member of the American Electro-Chemical Society and other Societies, a Fellow of the American Institute of Chemists and the author of many articles published in various trade papers. He holds financial interests in a number of metal plants in various parts of the United States.

NEW QUICK DRYING FINISH

The progress of chemical research in developing a new finish for domestic purposes was explained by Dr. Charles M. A. Stine, director of chemical research of the duPont Company, Wilmington, Del.,

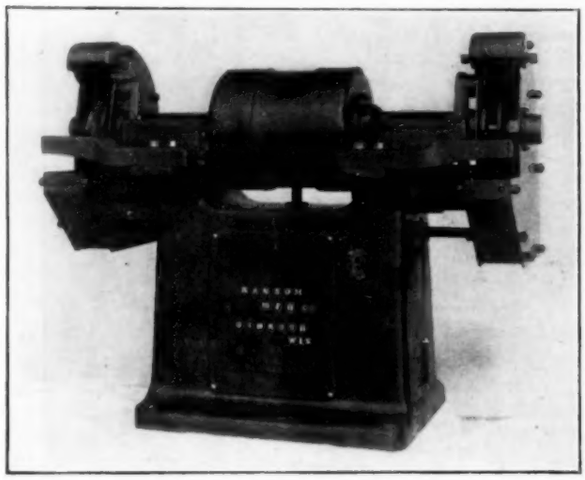
under whose direction the Duco finish for automobiles, furniture and industrial uses was developed and perfected. Speaking before the Ontario Retail Hardware Association, he told the story of the creation of a quick drying finish which can be brushed to produce a film which would be "durable, waterproof, tough, hard, elastic, have good adhesion to the surfaces to which it is applied, which would have no tendency to lift off the old paint and varnish surfaces, which would have good gloss and hiding power and above all be fast drying."

Dr. Stine, in explaining each stage of the research development told of the experiments to produce the requisite brushing properties, of the concentration of the solutions and development of chemically pure pigments and of the accurate control of every step in the manufacture in order that the finished formula.

RANSOM GRINDING MACHINE

The Ransom Manufacturing Company, Oshkosh, Wis., is manufacturing a direct connected motor driven grinding machine. One recently designed for one of the large automobile manufacturers, is shown in the illustration.

The machine has a Westinghouse motor, direct current, variable speed; that is the speed can be raised 75% above normal. This enables the user to maintain a constant periphery speed until the wheel is practically worn to the flanges.



RANSOM GRINDING MACHINE

This machine has removable sleeve bearings made of Lumen metal and the bearings are ring oiling. The motor instead of being totally enclosed has a slight ventilation, just enough to avoid excessive heat. The guards are made of steel plate riveted.

The machine is intended to operate 20x2" wheels. It is provided with Electric Controller & Manufacturing Company's automatic accelerating starter, operated by push-button shown in the front of the illustration. The machine weighs 2,000 lbs.

NEW MALLEABLE IRON FOR ZINCING

The Ohio Brass Company, Mansfield, Ohio, has developed a new metal which it has called "Flecto" iron. This is a type of malleable iron which, by virtue of a heat treating process, is said to be free from all tendency toward embrittlement when hot-dip zinced or galvanized. This announcement is made only now, but it is stated that all malleable iron castings produced by this manufacturer during the past two years have been treated by this process.

The most valuable characteristic claimed for the new iron is that it withstands galvanizing by the hot-dip method without any tendency to become brittle. Hot-dip galvanizing has long since been recognized as one of the best methods of rust proofing castings. However, ordinary malleable castings are very frequently embrittled by galvanizing. As a result, many substitute methods of rust proofing have been resorted to, but experience has shown the great desirability of hot-dip galvanizing if the bad effect upon the iron could be overcome. It is stated that this has now been accomplished in this new iron, and that treatment of castings by this process so improves the properties of the metal that all caastings of the Ohio Brass Company are being treated by this process, whether hot-dip galvanized or not.

The process for making Flecto iron is patented, but, according to the manufacturers, it is available to other manufacturers under a very liberal license arrangement.

ANACONDA PHOSPHOR BRONZE

The American Brass Company, Waterbury, Conn., is supplying phosphor bronze for various purposes and is prepared to make definite recommendation to manufacturers or engineers contemplating the use of this alloy.

In general the properties of Anaconda phosphor bronze are said to be as follows:

1. High Tensile Strength—maximum of 130,000 pounds per square inch, depending upon the alloy and temper.
2. High Elastic Limit—maximum of 90,000 pounds per square inch, depending upon the alloy and temper.
3. High resistance to fatigue—an 8% tin alloy under fiber stress of 37,600 pounds withstood 117,000,000 bends before breaking.
4. Low coefficient of friction—a phosphor bronze ring running in contact with a hardened steel surface, at a surface speed of 243 feet per minute lubricated with kerosene oil ran successfully for three hours at a pressure of 250 pounds per square inch and resulted in a coefficient of friction at the end of the test of .0013 and a rise of temperature of 80° F.
5. High resistance to corrosion and freedom from season cracking.
6. Minimum risk of giving off sparks when in contact with other metals.

Because of these properties, phosphor bronze is particularly suited for boiler fittings; for fittings exposed to sea water; for paper mill machinery parts, such as rolls and screens; for mechanical devices subject to repeated bending, friction and abrasion; for manufacturing explosives; for high speed bearings and for welding purposes.

SHEET METAL

Phosphor bronze, because of its toughness and high tensile strength is extensively used for spring purposes where a non-corrosive metal that successfully resists abrasion and retains high elasticity under repeated bendings is required.

SEAMLESS TUBES

These tubes are drawn hard. Where extreme accuracy is required, such as for bearings, sufficient thickness should be allowed to permit machine finishing. Tubes are also used for machinery parts, such as rolls, etc., which must resist corrosion or abrasion.

RODS

Parts made from cold drawn phosphor bronze rods are used for small bearings, bushings, valve parts, etc. Rods are also used for pump parts and similar engineering purposes. A special, free turning phosphor bronze rod is furnished for screw-machine work.

MACHINERY GUARDS

CLEVELAND GUARD

The Cleveland Blow Pipe and Manufacturing Company, 6050 Kinsman Road, Cleveland, Ohio, is preparing to install machinery guards on all classes of machines for safety purposes. Through their experience in sheet metal working, they have designed guards to meet various state regulations and constructed to give visibility to machines and strength to withstand hard usage.

Guards are made in perforated sheets, solid metal, wire cloth, reinforced with angle iron, and "steelcrete" metal to cover fly-wheels, gear belts, motors, chains, balance wheels, friction clutches, spindles, and various other mechanical parts.

EQUIPMENT AND SUPPLY CATALOGS

Green Forced Draft Stokers. Combustion Engineering Corporation, Broad street, New York.

Principles and Scope of Budgeting. Metropolitan Life Insurance Company, New York.

Some Developments in the Electrical Industry During 1925. General Electric Company, Schenectady, New York.

Pynolag Pyrometer Protection Tubes. Louis C. Eitzen Company, 280 Broadway, New York City.

Multiple Retort Underfeed Stokers. Detroit Stoker Company, No. 103 General Motors Building, Detroit, Michigan.

Governor Controlled Self-Lowering Jacks. Duff Manufacturing Company, Pittsburgh, Pa.

Anaconda Copper Anodes. American Brass Company, Waterbury, Conn.

Electric Night By Radio. General Electric Company, Schenectady, New York.

Silicate of Soda. Philadelphia Quartz Company, 121 South Third street, Philadelphia, Pa.

Seamless Copper and Brass Tube Equipment. Ludwig Wolffgram, 209 Decatur street, Sandusky, Ohio.

Measurement of Water. Republic Flow Meters Company, 2240 Diversey Parkway, Chicago, Ill.

Tool Steel. Henry Disston & Sons Company, Tacony, Philadelphia, Pa.

Forging Insulator Pins. The National Machinery Company, Tiffin, Ohio.

Cutting and Welding Torches. Alexander Milburn Company, Baltimore, Md.

Smooth-On Handbook. Smooth-On Manufacturing Company, Jersey City, N. J.

Combustion Steam Generator. Combustion Engineering Corporation, Broad street, New York City.

High Speed Brass Rod. Scovill Manufacturing Company, Waterbury, Conn.

ASSOCIATIONS and SOCIETIES

REPORTS OF THE CURRENT PROCEEDINGS OF THE VARIOUS ORGANIZATIONS

AMERICAN FOUNDRYMEN'S ASSOCIATION

HEADQUARTERS, 140 SOUTH DEARBORN STREET, CHICAGO, ILL.

The American Foundrymen's Association announces an extensive program of technical sessions for the Second International Foundrymen's Congress to be held at Detroit from September 27 to October 1. Foundrymen from each branch of the industry, steel, malleable, cast iron and non-ferrous, will find much of the greatest interest in the sessions scheduled for each day of the convention. The sessions will cover all phases of foundry practice, metallurgical, shop and general management.

Sessions which will appeal to all foundrymen will be as follows: Foundry Costs; Foundry Refractories Problems; Sand Control in the Foundry; Permanent and Long Life Molds; Apprentice Training; Materials Handling; Management.

The non-ferrous sessions will be joint meetings of the A. F. A. and Institute of Metals Division of the A. I. M. E. These special sessions will be symposiums on temperature control, and casting nickel alloys; a luncheon round table discussion on brass foundry problems and a session on casting aluminum and aluminum alloys.

The tentative schedule of technical sessions in general and on metals is as follows:

Monday, September 27—1:30 p. m., Opening Meeting, Address of Welcome and Responses. 3:00 p. m., Non-Ferrous Metals; Material Handling.

Tuesday, September 28—10:00 a. m., Non-Ferrous Metals; Apprentice Training. 12:15 p. m., Luncheon Meeting and Round Table Discussion, Brass Foundry Problems. 2:00 p. m., Symposium on Permanent and Long Life Molds.

Wednesday, September 29—10:00 a. m., Institute of Metals Division, A. I. M. E. 2:00 p. m., Costs; Foundry Refractories.

Thursday, September 30—10:00 a. m., Foundry Sand Control. 1:30 p. m., Business Meeting; Management.

Friday, October 1—10:00 a. m., Foundry Sand.

EXHIBITS GET FREE RETURN

In past years exhibitors have been refused their request for free return of exhibit material at conventions. It was felt that exhibitors were entitled to free return and following the Syracuse Convention it was decided to get a ruling.

It was also decided, with the cooperation of one of the exhibitors, the National Engineering Company, to make a test case. A letter was addressed to the attention of the District Freight Accountant of the New York Central asking for a refund, and shortly afterward this refund was received.

The American Foundrymen's Association will cooperate with all exhibitors in a similar way that they may receive refunds. Before shipments are made for the next convention, the committee will have made such progress as to enable shipments to be returned free.

QUAD-CITY FOUNDRYMEN

HEADQUARTERS, EAST MOLINE, ILLINOIS

The Quad-City Foundrymen's Association held their February meeting at the Chamber of Commerce, Davenport, Monday evening, February 15, 1926, at 6:30 P. M. Seventy-five members were present for the dinner and talk, which followed.

E. S. Cohen, Engineer of the Stoney Foundry Engineering and Equipment Company of Cleveland, Ohio, spoke on "Foundry Engineering."

PHILADELPHIA FOUNDRYMEN

HEADQUARTERS, CARE OF HOWARD EVANS, UNION LEAGUE, PHILADELPHIA, PA.

The 352nd dinner and meeting of this Association was held on Wednesday evening, February 10, 1926, at Manufacturers Club.

H. M. Riddle, Jr., Treasurer, Asbury Graphite Company, Asbury, N. J., addressed the meeting on Graphite and Plumbago.

SOCIETY FOR TESTING MATERIALS

HEADQUARTERS, 1315 SPRUCE STREET, PHILADELPHIA, PA.

ZINC COATING SPECIFICATIONS

The Sectional Committee on Specifications for Zinc Coating of Iron and Steel functioning under the rules of Procedure of the American Engineering Standards Committee, was organized under the sponsorship of the A.S.T.M. at a well-attended meeting held in New York City on October 9, 1925. The purposes of the committee are formally stated as follows:

Development of nationally uniform specifications for the adequate protective coating of different classes of zinc coated products, including: outside electrical construction; inside electrical construction, including conduits; sheets and plates and products fabricated therefrom, for outside use; sheets and plates and products fabricated therefrom, for inside use; water pipes and associated valves and fittings; agricultural implements, tools and small general hardware; marine hardware and ship fittings; rivets, bolts and nuts, screws, nails; structural shapes; fencing material and woven wire cloth; and including all forms of zinc coating for iron and steel —hot galvanizing, sherardizing, electroplating, spray coating—and methods for the testing of all such coatings.

The committee is made up of 43 officially appointed representatives from 31 organizations, among whom are the following:

Sponsors: American Society for Testing Materials.

American Electroplaters Society, M. E. Stewart.

American Institute of Mining and Metallurgical Engineers, C. S. Trewin.

American Society for Testing Materials, J. A. Aupperle, J. A. Capp, H. E. Smith, Jesse L. Jones.

American Zinc Institute, G. C. Stone, (alternate) A. W. Dodd.

United States Bureau of Standards, H. S. Rawdon.

The committee elected as its officers: Chairman, J. A. Capp, Chief of Testing Laboratory, General Electric Company, Schenectady, N. Y.; Vice-Chairman, C. S. Trewin, Technical Department, New Jersey Zinc Company, New York City; Secretary, Stephen S. Tuthill, Secretary, American Zinc Institute, New York City.

AMERICAN ELECTROCHEMICAL SOCIETY

HEADQUARTERS, COLUMBIA UNIVERSITY, NEW YORK

The program of the Chicago meeting, April 22-24, 1926, is assuming a definite form. The Local Committee, under the Chairmanship of Dr. H. C. Cooper, is preparing an elaborate entertainment program. The feature of the technical program will be a symposium on "Chlorine," D. A. Pritchard, Chairman. Among the papers will be the following.

Metallic Chlorides (Silicon, Titanium, Tin, Antimony, Zinc and Aluminum).—P. S. Brallier, Niagara Falls.

Chlorine in Detinning.—Chas L. Mantell, Pratt Institute, Brooklyn, N. Y.

The Electrothermic and Electrodeposition Divisions will hold special sessions at luncheon during the meeting. The Electrothermic Division will discuss the "Comparative Merits of Electric and Fuel-Fired Furnaces." The Electrodeposition Division will discuss "The Selection of the Proper Plating Metals," i.e., a comparative discussion of different coatings from a practical standpoint.

HARTFORD BRANCH, A. E. S.

HEADQUARTERS, CARE OF TENNANT ELWIN, 1145 BOULEVARD, WEST HARTFORD, CONN.

At the last meeting of the Hartford Branch of the American Electro-Flaters' Society, Charles H. Buchanan of the Eli Anode and Supply Company, Inc., gave a talk on Nickel Anodes, their purity, corrosion, and durability. He showed samples of nickel anodes which had been run in a nickel solution and also samples of 99% + anodes broken to show the fine grain.

INTERNATIONAL FELLOWSHIP CLUB

HEADQUARTERS, CARE OF J. C. OBERENDER, ZAPON COMPANY, NEW HAVEN, CONN.

A meeting was held at the Aldine Club, New York, on Saturday afternoon, February 20, 1926,

A very fine luncheon was served, after which talks were given by the officers of the International Fellowship Club, followed by a talk by Gavin J. Tyndall of the George Claflin Company. Members were also indebted to A. P. Munning of the A. P. Munning Company for the very fine talk he gave.

Out of the small number who thought of this organization at Milwaukee has grown an organization which has on its roll at the present time 44 members. These members cover every branch of industry connected with the finishing and protection of metals.

CHEMICAL EQUIPMENT MANUFACTURERS

HEADQUARTERS, 1328 BROADWAY, NEW YORK

C. B. Murray, Secretary of the Ohio Section of the American Institute of Mining & Metallurgical Engineers, J. Rowland Brown, American Society of Mechanical Engineers, James H. Herron, ex-National Council Member of the American Society of Mechanical Engineers and W. H. Eisenman, National Secretary of the American Society for Steel Treating, have been appointed members of a special committee representing almost every phase of engineering and chemistry, to co-operate in preparing an unusual technical program to occur throughout the week of May 10-15, 1926, in conjunction with the Second Chemical Equipment, Machinery and Process Engineering Exposition of the Association of Chemical Equipment Manufacturers in Cleveland.

In addition to these three societies, chapters or membership groups of the American Chemical Society and American Electrochemical Society and others are also involved.

The Exposition mentioned above is a showing of equipment, materials, machinery and accessories basic to the application of all the chemical processes to industrial production. It will be held in the $6,000,000 Public Hall in Cleveland and will include the latest devices, methods, operating equipment and machinery, etc., used in or adaptable to the use of chemical processes.

The technical program will cover a practical consideration of chemical processes, electrochemical processes, materials of construction with particular reference to iron and steel, metals, alloys and rubber. The sessions will begin Monday, May 10, 1926, and continue throughout the week. They will be held in the Hotel Hollenden, two blocks from the Public Hall.

WASTE MATERIAL DEALERS

HEADQUARTERS, TIMES BUILDING, NEW YORK

The Thirteenth Annual Meeting of the Association at which will be elected a President for a term of one year and fifteen Directors to serve for two years and one Director for one year to fill a vacancy, will be held at the Hotel Astor, New York, on Wednesday, March 15-17, 1926.

The Metal Division will hold a meeting at the Hotel Astor, Tuesday, March 16, at 2 P. M. J. W. Patterson will preside.

OIL BURNER ASSOCIATION

HEADQUARTERS, 350 MADISON AVE., NEW YORK

The Third Annual Convention and Exposition of the American Oil Burner Association, will be held at the Book-Cadillac Hotel, Detroit, Michigan, April 6th, 7th and 8th.

The convention program will be a focus of oil burning information and the exposition will be the largest exhibit of oil burning and auxiliary equipment ever shown under one roof.

ELECTROPLATERS' AND DEPOSITORS

HEADQUARTERS, CARE OF WILLIAM E. HARRIS, 193 EVERSLEIGH ROAD, BATTERSEA, S. W. 1, LONDON, ENGLAND

The Electroplaters' and Depositors' Technical Society has been in existence only two months but now has over 100 members.

They held a members meeting in London, on January 13, 1926, which took the form of a round table discussion on Silver Plating. Contributions to the discussion were received from Germany.

The discussion ranged round the following points:

The cause of the black stain on Silver anodis other than the deposit due to insufficient free cyanide.

The relative advantages or disadvantages of Silver baths made up with Potassium Cyanide and Sodium Cyanide.

Current densities, some as high as 13.5 amps per sq. ft.

Potassium carbonate in solution.

Aging of solution—addition agents to bring this about quickly.

The second open meeting was held on Wednesday, February 10, 1926, at the Northampton Polytechnic Institute, St. Johns St., London, E. C., when a paper entitled A General Survey of Chromium Plating was read by E. A. Ollard of the Research Department, Metropolitan-Vickers Electrical Company, Ltd., Trafford Park, Manchester. F. S. Spiers occupied the chair and altogether 80 members were present. The paper was illustrated with lantern slides and with chromium plated examples of motor car, bathroom and electrical fittings, besides several examples of heavy deposits and also dull and bright deposits.

The next meeting will be held at the same place on March 10, 1926, when a discussion will take place on Cleaners in Use in Electroplating. This discussion will be opened by E. J. Dobbs of Birmingham. Further particulars can be obtained from the Hon. Secretary William E. Harris, 193 Eversleigh Road, Battersea, London, S. W. 1, England.

GERMAN METALLURGICAL SOCIETY

HEADQUARTERS, CARE OF DR. W. GUERTLER, TECHNISCHE HOCHSCHULE, BERLIN, GERMANY

The German Metallurgical Society (Deutsche Gesellschaft fur Metallkunde) held its sixth annual meeting at Breslau, October 18-20, the chair being occupied by Professor W. Guertler, of the Technische Hochschule, Berlin, the President of the Society. The following are the papers presented, which deal with a wide range of problems of considerable practical importance.

Recent Technical and Scientific Developments in the Metal Industry. By Chief Engineer Czochralski, Frankfort.

The Present State of Development of Non-Ferrous Electric Melting Furnaces. By Dipl. Ing. Tama, Berlin.

The Determination of Some Properties Important to Pouring and Hot Working of Metals. By Dr. F. Sauerwald, Breslau.

The Aging of Aluminum Alloys. By Dr. K. L. Meissner, Berlin.

The Dependence of the European Metal Industry Upon America. By Assessor H. Littauer.

The Behavior of Aluminum Towards Iron at Elevated Temperatures. By Dr. R. Irmann.

The Cracking of Hot Rolled American Wire Bars. By Chief Engineer W. Wunder, A. E. G., Berlin.

New Alloys of Silver. By Prof. Dr. W. Guertler, Berlin.

Personals

DR. PAUL D. MERICA

Dr. Paul D. Merica was elected chairman of the Institute of Metals Division of the A. I. M. E. at the annual meeting in February, 1926, in New York. Dr. Merica's career was described in our issue of September, 1924, substantially as follows:

He was born in Indiana and received most of his early education there, attending De Pauw University, graduating later, however, from the University of Wisconsin.

After an additional year in the physics department of this university he received an invitation from the government of the Province of Chekiang, China, to teach chemistry at Provincial College of this province. This was accepted and he spent two years at Hang Chow, China. In 1911 he went to Berlin, primarily to take up again his chemical and physical studies, first at the Chemical Institute of Professor Emil Fischer and later at the Technische Hochschule at Charlottenberg. It was there that he first became definitely interested in metallurgy through his work in the metallographic laboratories of Professor H. Hanemann, where he remained until 1914, taking finally his Ph. D. in chemistry and metallurgy. It was just about six months before the opening of the war that he returned, after a five years' absence, to this country to engage in metallurgical research work.

DR. PAUL D. MERICA

After a few months spent at the Engineering Experimental Station of the University of Illinois on a special research on the embrittlement of boiler steel in association with Professor S. W. Parr, Dr. Merica joined the metallurgical staff of the U. S. Bureau of Standards under its then chief, Dr. G. K. Burgess.

At the Bureau attention was engaged perhaps predominantly in non-ferrous metals, particularly wrought brass and aluminum alloys. During the years 1914-1916 much attention was given by the Bureau of Standards to certain failures of brasses and bronzes in the construction of the Catskill Aqueduct and Dr. Merica in collaboration with others conducted several investigations into the matter, publishing later a number of papers on the subject. Subsequently, during the period of our entry into the war the production of high strength light aluminum alloys in this country became a matter of considerable importance, and he had charge at the Bureau of Standards of the investigational work along these lines. This resulted, among other things, in the determination of the nature and mechanism of the heat-treatment of aluminum alloys of the Duralumin type and the improvement of the technique of heat treatment of these alloys. At this time Dr. Merica was assistant Chief of the Metallurgical Division of the Bureau.

In 1919 Dr. Merica left the Bureau of Standards to associate himself with The International Nickel Company at its Orford plant, where he later became Superintendent of Research. In 1922 a new department of this company was organized, the Development and Research Department, for the purpose of developing new commercial uses for nickel and new nickel products. Dr. Merica became associated with this department and at present is Director of Research for The International Nickel Company, in New York City, and assistant manager of its Development and Research Department.

Andrew V. Re is installing a plating and polishing department for the A. R. G. Auxiliary Spring Company, Birmingham, Ala.

W. J. Bell is now in charge of the Gill Glass Company, Amber and Venango streets, Philadelphia, Pa. This company started a plating department in November, 1925.

John K. Desmond, formerly with Philadelphia district sales office of the Crucible Steel Company of America, has been appointed Philadelphia district manager of steel sales for Henry Disston & Sons, Philadelphia.

Raymond J. O'Connor, secretary of the Bridgeport Branch of the American Electro-Platers' Society and member of the 1926 Research Committee, recently attended a meeting of the committee in Chicago. While in that vicinity Mr. O'Connor visited a number of the large plating plants.

A. G. J. Rapp, who for over thirty years has specialized principally in the design, development and installation of foundry sand mixing, preparing and handling equipment, is now in charge of the engineering department of the National Engineering Company, Chicago, Ill.

C. R. Spare resigned January 1, 1926, as president of the American Manganese Bronze Company, Holmesburg, Philadelphia, Pa., his interest going to T. H. Addie. Mr. Spare is now vice-president and general manager of the Janney Cylinder Company, 4425 State Road, Tacony, Philadelphia, Pa., which operates a non-ferrous metal foundry to make pump liners. **W. J. Janney,** president, was formerly with the American Manganese Bronze Company.

Jerome Salomon, son of S. Salomon of the Columbia Smelting and Refining Works, has entered the Anode Corporation of America, 489 Broome street, New York, as treasurer, holding 33 1/3 per cent of the stock of that company. Payment for shares mentioned have been deposited to the credit of the corporation as increased working capital. The company is enlarging its facilities and will shortly be in a position to handle the anticipated increase of business.

W. J. Schneider, for fourteen years representative of Roessler & Hasslacher Chemical Company, of New York, in the East and known to the trade as "Cyanide Bill," has resigned from that company. He has joined the National Metal Etching Corporation, Long Island City, N. Y., as vice-president, having taken a substantial interest in that corporation. They have built a two-and-a-half story building with 57,000 square feet of floor space. Their main line is the production of etched name plates of all kinds and sizes; also all other etched products. E. Rogge is president.

Herman Steinkraus recently assumed the representation of of **Bridgeport Brass Company** products in the Cleveland territory. He has resided in Cleveland for a number of years. A graduate of Western Reserve University, he has handled sales and organization work in managerial capacities for the Cleveland Automatic Machine Company and a number of other organizations. The last eight years have been spent with the Osborn Manufacturing Company, from which he resigned not long ago as general sales manager. Mr. Steinkraus' continuous sales work was interrupted only by his service in the World War when enlisting as a private. He was promoted to captain after being awarded the D. S. C. in the Argonne. Mr. Steinkraus has charge of the Bridgeport Brass Company's Cleveland warehouse service as well as sales.

Obituaries

DANIEL M. BRADY

As we go to press, word comes of the death of Daniel M. Brady, president and treasurer of the Brady Brass Company, Jersey City, N. J., on February 23, 1926, at his home in Atlantic City, N. J. He was 71 years old.

Mr. Brady, who was the brother of the late "Diamond Jim" Brady, head of Manning, Maxwell & Moore, Inc., started his business career with the New New York Central Railroad Com-

pany in 1871 and established the Brady Brass Company after his retirement from railroad activity. He was at one time identified with Chauncey M. Depew in railroad work. Mr. Brady is survived by his widow and a sister, Mrs. Harriet Mathiew.

A fuller report of Mr. Brady's career will be published in our next issue.

WALTER J. WATSON

Walter J. Watson, died suddenly at Plainfield, N. J., January 7th, at the age of 80 years. Mr. Watson, who was associated with the Watson-Stillman Company, New York, for fifty years, entered the employment of that company in 1870, and in November 1920, was retired.

WILLIAM J. MILLS

William J. Mills, founder and president of the William J. Mills Brass Works, died recently, at his home, 50 Linden Boulevard, Brooklyn, N. Y., in his 86th year. He had lived in Brooklyn for sixty years and had been active in Republican politics in that borough, serving for two years as supervisor of the old Nineteenth Ward. He was a member of Ivy Lodge, I.O.O.F., and leaves a widow and two sons.

WILLIAM C. MUNDT

William C. Mundt, president of Charles Mundt and Sons, Perforated Metal, 59 Fairmount Avenue, Jersey City, N. J., died recently, of heart disease in Palm Beach, Fla., being stricken as he entered his suite in the Royal Poinciana Hotel. Mr. Mundt was born in New York City, 47 years ago. When a younger man he started the business there with his father, moving it to Jersey City in 1908. He was a life member of Jersey City Lodge No. 211, B. P. O. E. He is survived by his widow, Lydia, and his brother, Fred Mundt of Jersey City.

CHARLES HENSSLER

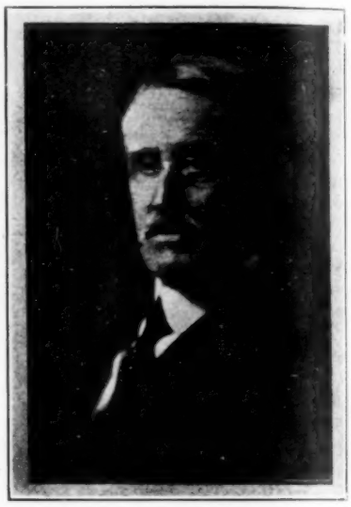
Charles Henssler, 79 years old, of 211 Mercer street, Trenton, N. J. for 50 years an employe of the Skillman Hardware Manufacturing Company, died at his home on January 7 after a long illness. Six of the older employees of the Skillman Company acted as pall bearers.

The deceased came to Trenton 60 years ago and gained considerable renown as an artisan, being known as one of the most skillful patternmakers and lockmakers in the country. Not only did he design most of the locks manufactured by the Skillman Company, but he also invented and patented several types of locks which now enjoy wide sale and distribution. Mr. Henssler, who was born in Germany, apprenticed himself at the age of 15 to the locksmith trade and traveled over most of Europe. His hobby was walking and he walked to work in all kinds of weather.

MARK LEAVENWORTH SPERRY

Mark Leavenworth Sperry, president of the Scovill Manufacturing company of Waterbury from 1918 to 1920 and director of the company for 50 years, until the time of his death, died at St. Petersburg, Florida, February 10, 1926. He had been in failing health for years, which in 1920 caused him to resign the presidency of the Scovill company after a two-year term. The funeral was held in Waterbury, February 14, 1926.

He was born in Waterbury, October 23, 1842, the son of Corydon S. Sperry and Catherine Leavenworth Sperry. His mother was the daughter of Mark Leavenworth, one of the pioneer manufacturers of Waterbury. His brother was Admiral Charles S. Sperry, commander of the fleet in the round-the-world cruise during President Roosevelt's administration. He went to work at the age of 15 in the office of the Waterbury Knitting Company and five years after became bookkeeper for the Scovill Manufacturing Company; was elected secretary of the company in 1869 and a director in 1876. In 1918, on the death of C. P. Goss, Sr., he became president of the company but resigned after two years, however, continuing as director. He was connected with the company for 64 years. He was vice-president of the Dime Savings Bank and the Waterbury Trust Company of Waterbury.



MARK LEAVENWORTH SPERRY

He was vice-president of the Greene Cananea Consolidated Company until it was acquired by the Anaconda Company and later became a director of the Chino Consolidated Copper Company. During his connection with the copper industry he made many trips of inspection through Mexico and formed friendships with President Diaz of Mexico and Gov. Terrarzas of Chihuahua. He is survived by his wife, two daughters, Mrs. Walter D. Makepeace, and Ruth Sherman Sperry; three sons, Leavenworth P. Sperry, secretary of the Scovill company; Roger S. Sperry and Mark L. Sperry.

NEWS OF THE INDUSTRY

BUSINESS REPORTS OF THE METAL INDUSTRY CORRESPONDENTS

WATERBURY, CONN.

MARCH 1, 1926

The **Scovill Manufacturing Company** has purchased the entire capital stock of the **Gilchrist Company,** of Newark, N. J., a concern making fixtures and equipment for druggists and soda fountain trade. The price paid has not been stated, but the concern was capitalized at $250,000. It employs approximately 175 hands.

This makes the fifth concern that has been acquired by the Scovill Company within the past few years; the **Hamilton-Beach Company,** of Racine Wisconsin, manufacturers of vacuum cleaners and accessories; the **Morency-Van Buren Manufacturing Company,** of Sturgis, Mich., manufacturers of plumbers supplies; the **American Pin Company,** of Waterville, and the **Oakville Company,** of Oakville, the two latter manufacturing pins and other small articles in Waterville and Oakville, suburbs of Waterbury.

New officers of the company, consisting almost wholly of Scoville Company officials, have been elected since the purchase. They are: President, **E. O. Goss,** president of the Scovill Company; vice-president, **Thomas B. Myers,** assistant secretary of the Scovill Company and vice-president in charge of the Hamilton-Beach Company; secretary, **L. P. Sperry,** secretary of the Scovill Company; treasurer and general manage, **Thomas Jameson,** of Newark. The above named, together with **John H. Goss,** first vice-president of the Scovill Company, constitute the board of directors. The business will continue to be conducted at Newark in the same manner as before.

All officers and directors of the Scovill Manufacturing Company were re-elected at the annual meetings of stockholders and directors, Feb. 9. An extra dividend of $3 a share was

declared on the common stock. Regular dividends paid during the year amounted to $12 per share. The annual report showed a net surplus of $2,623,145.82 for the year which added to the surplus at the beginning of the year makes a total surplus of $9,246,395.72. There are 177,000 shares of stock outstanding. Total profits from sales for the year amounted to $4,114,695. Total capital and current assets, after all deductions, amounted to $34,322,322.

The officers re-elected are: President, **E. O. Goss**; first vice-president, **John H. Goss**; vice-president in charge of the Oakville Company division, **Bennett Bronson**; vice-president in charge of the American Pin Company division, **T. I. Driggs**; secretary, **L. P. Sperry**; assistant secretary in charge of the Racine plant, **T. B. Myers**; assistant secretary, **B. P. Hyde**; assistant secretary, **W. W. Bowers**, sales manager of the American Pin division; assistant secretary, **C. F. Doherty**, Oakville division; treasurer, **C. M. DeMott**; assistant treasurer, **Frank J. Gorse**; assistant treasurer, **W. M. Goss**.

The directors elected are: M. D. Sperry (since deceased), C. M. DeMott, E. O. Goss, John H. Goss, W. Shirley Fulton, F. J. Kingsbury, C. P. Goss, Jr., L. P. Sperry and George A. Goss.

The four-story brick factory of the **Waterbury Fastener Company** was almost totally destroyed by a fire, Jan. 29. The loss was between $150,000 and $200,000. The four walls remained standing, but practically the entire interior was destroyed. The fire is thought to have started in the lacquer room. Since the fire, the company has purchased the two-story brick factory, formerly occupied by the **Gordon Electric Company**, in Waterville. The latter company went out of business about one year ago and the building has been held by the **Chase Companies**, since.

F. S. Chase, president of the **Chase Companies**, was re-elected president of the Boys' Club at the annual meeting of the directors, held last month.

Charles T. Brennan of this city has been granted a patent for a mechanism for feeding metal blanks. The patent has been assigned to the **E. J. Manville Machine Company**.

Andrew C. Campbell, president and founder of the **A. C. Campbell Company**, of this city, and consulting engineer of the **American Chain Company**, died at his home here, Feb. 21. He was widely known as an inventor of note and a national authority on mechanical subjects. He was connected with the Wheeler & Wilson Sewing Machine Company, of Bridgeport, for several years and for 16 years was secretary and general manager of the E. J. Manville Machine Company of this city. He left it in 1910 to found the A. C. Campbell Company, machinery manufacturers and engineers. The American Chain Company now has a substantial interest in it.

He had traveled widely all over Europe and the Orient, and was a recognized authority on Japanese bronzes of which he had an extensive collection. He was born in New York in 1856. He leaves his wife; two sons, L. Barrett and Harold W.; one daughter, Helen; one sister, Mrs. D. J. Hooper, of Philadelphia, and two brothers, John R., of New York, and Charles H., of Salt Lake City.—W. R. B.

BRIDGEPORT, CONN.

March 1, 1926.

The assessment of the **Bridgeport Brass Company** on the city grand list has been reduced by $797,000 by the board of relief on the recommendation of Tax Assessor William F. Connelly. This is the largest reduction made on the Bridgeport grand list. With this decrease, the brass company is now assessed at nearly $1,100,000 less than on the list of the previous year, that assessment having been $5,054,138. The assessment is now not quite $4,000,000. The reduction made is due to a decrease in the inventory valuation of the company.

A judgment of $44,416.95 secured by the **Remington Arms Company** against the **Gaynor Manufacturing Company** has been knocked out as a preferred claim by a decision of the Supreme Court of Errors and has been put on the list of the Gaynor company's liabilities as an ordinary claim. The suit dates back to 1917 when it was brought by the Remington company against the Gaynor company for an alleged contract failure.

A trade-mark, comprising the words, "Crucible Brand," together with a depiction of the crucible has been registered with the United States Patent Office by the **Acme Shear Company** of this city for use in connection with the scissors and other articles manufactured by the company. "Signalite," a trade mark which has been used by **Harvey Hubbell, Inc.**, of this city, in connection with its manufacture of electric signal lamp accessories for several years, has also been registered by the patent office. Another trade-mark, registered last month, is "Harmony," the property of the **Columbia Phonograph Company, Inc.**, used in connection with the manufacture of various phonographic apparatus, needles, recorders, diaphragms, needle cups, horns, tone arms, mechanical phonograph motors, etc.

James Chasmar, superintendent of the **Remington Arms Company**, was unanimously elected president of the Engineers' Club, at the fourth annual meeting of the club, held last month, in the Stratfield hotel. **Kenneth C. Monroe**, engineer of the **Bridgeport Brass Company**, was elected secretary; **John G. Hughes**, engineer of the **Crane Company**, was elected treasurer, and **Arthur Jenner**, superintendent of the **Columbia Phonograph Company**, was elected chairman of the meetings committee.

C. Albert Willard, head of the Industrial Bureau of the Chamber of Commerce, declared at a meeting of the Rotary Club, last month, that more factories must be brought to the city if it is to grow. Since the organization of the bureau, last July, Mr. Willard has interviewed 99 heads of industries with the view of inducing them to move here. Of that number, 54 were active prospects; 13 of them had moved elsewhere; 12 were "no good," that is, wanted a bonus or other prohibitive favors; 13 will not move and 7 have been persuaded to locate in this city, representing a 7 per cent return on the prospects interviewed.—W. R. B.

TORRINGTON, CONN.

March 1, 1926.

Uri T. Hungerford is a pneumonia patient at Nice, France, where he went last fall to spend the winter. Mr. Hungerford first suffered a cold and this developed into pneumonia. Specialists were summoned to his bedside from Berlin and Paris. Mr. Hungerford recently passed his 84th birthday.

The contract for the new state trade school building here has been awarded to the **Torrington Building Company**. The bid was $60,000.

John H. Goss, vice-president of the **Scoville Manufacturing Company**, of Waterbury, spoke before the Torrington Club on Feb. 8 on "Relations Between Employer and Employee"; and **John A. Coe**, of the **American Brass Company**, of Waterbury, spoke before the men of the Methodist church on Feb. 15 on "Training Thrift and Thoroughness."

Estimates based on school figures and other statistics indicate that the present population of Torrington is close to 30,000.

Work is progressing rapidly on the new factory building being erected for the **Hotchkiss Brothers Company**.

The general industrial situation in Torrington is reported as good, especially so far as the metal plants are concerned. Orders are coming in satisfactorily, and taken altogether the outlook for the coming months is bright.

Congress has passed the bill which includes an appropriation of $180,000 for a new post office building in Torrington. The present postal quarters have been inadequate for some time. —J. H. T.

NEW BRITAIN, CONN.

March 1, 1926.

Reports submitted at annual meetings of the various metal manufacturing concerns in this city all reflect good business for the past year, sound business policies being followed and indicate that the outlook is good. Especially interesting is the statement of the **New Britain Machine Company**, the annual meeting of which was held February 24. Adjustment in government contracts, income tax matters and sundry items brought a total of $379,728.12 to the machine company which only a couple of years ago was generally believed to be on the verge of bankruptcy. The net profit during the year is given

as $288,880.46, after all necessary deductions. During the year a dividend of 3½ per cent on class "A" preferred stock was declared. There is a strong demand for this company's stock at present and its come-back to a live, competitive concern is one of the wonders of the New England manufacturing circles.

On February 4, during the first blizzard which swept this district, the annealing department of the **North & Judd Manufacturing Company** suddenly collapsed, causing the death of eight men and serious injuries to a score of others. The physical damage to the plant was extensive, since this building was completely wrecked, together with all equipment. Already, work has been started in erecting a new annealing building 244 feet long and 70 feet wide at a cost of about $40,000. At the present writing the status of the company relative to the disaster has not been determined since the prosecuting authorities have not made their report on the charge that the company is at fault inasmuch as the firm is said to have made extensive and heavy alterations to the roof of the structure without taking out a building permit or permitting inspection by the building department. There also is some talk of possible legal action by relatives of the dead or injured workers, although the state compensation commissioner already has ruled substantially for the families of the men whose lives were sacrificed in the collapse. The loss of the annealing department is not interferring materially in the output of the concern and temporary arrangements were promptly made.

The **American Hardware Corporation** at its annual meeting re-elected the present board of directors and officers and voted a quarterly dividend of $1 payable April 1. The **Hart & Cooley Manufacturing Company** has re-elected its staff of officials and declared a regular dividend of $1 payable April 1. The only change in the governing staffs of any of the plants occurred at the **New Britain Machine Company** where **E. Allen Moore,** chairman of the board of directors of the **Stanley Works,** declined to accept reappointment as a director, a position he has held for four years. Mr. Moore resigned for reasons of health and because he felt that the concern no longer needed his services. The chairman of the board of directors is **John Goss** of the **Scovill Manufacturing Company** in Waterbury.

Summarizing all of the industries in this city it may be said that labor conditions are good, there is practically no unemployment, the volume of business being handled is satisfactory and the spring outlook is for a busy period.—H. R. J.

PROVIDENCE, R. I.

MARCH 1, 1926

The first two months of 1926 have more than verified the optimistic views that prevailed at the close of the old year. That the tendency is toward a more normal and sound condition cannot be gainsaid for, in practically every metal trade line there has not only been a better tone manifested, but there has been a constant and steady improvement ever since the beginning of the new year; and this, notwithstanding that the building trades and the jewelry branches have not as yet got a fair start.

The **Electric Chain Company,** located at Attleboro, has been granted a charter under the laws of Massachusetts and has taken over the **Johnston Manufacturing Company.** The capital stock is $300,000, consisting of 300 shares of preferred stock at $100 each and 400 shares of common stock without par value. **Alfred S. Rees,** who has been with the company since its inception in 1900, and **Gilbert C. Hall,** for the past eight years a director and its secretary, have retired. **George F. Sawyer,** who went to Attleboro and to the company in 1909, remains as its president. **Alfred Walker,** for 14 years with the **W. E. Hayward Company,** but during the last year a member of the firm of Walker Brothers, is treasurer. Associated with them will be **Frederic S. Johnston, Frederick A. Bagnall** and **Frederick A. Phillips,** all of whom have been identified with the jewelry business in the Attleboros for a number of years.

Kennedy & Company, manufacturing jewelers of Attleboro, have discontinued business. **Frank P. Kennedy,** head of the concern, having removed to Florida, where he has large interests.

Guyot Brothers Company has been incorporated under the laws of Massachusetts to conduct the manufacture of jewelers' findings and metal novelties at Attleboro, with an authorized capital of $100,000. The incorporators and officers are as follows: President, Arthur F. Guyot, who is also treasurer; vice-president and secretary, Gaston A. Guyot and Carl W. Kell.

Arnold Ochs & Company has been incorporated under the laws of Rhode Island for the purpose of manufacturing a general line of jewelry and novelties at 144 Pine street, Providence, with an authorized capital consisting of 1,000 shares of common stock without par value. The incorporators are Gustav Ochs, Arnold M. Detlin and George W. Bugbee, all of Providence.

The stockholders of the **American Screw Company** held their annual meeting at Providence on February 9 at the office of the Company, 558 Eddy street, with the president, **Samuel M. Nicholson,** presiding. A retrospect of the year's business of the country as a whole showed a steady improvement which should continue for at least a considerable part of 1926, justifying the confidence that the company's business for the ensuing year would be reasonably satisfactory.

The annual meeting of the **Nicholson File Company** stockholders was held on February 10 at the office of the concern, 23 Acorn street, Providence. President **Samuel M. Nicholson** read his annual report covering the activities of the company for the year 1925, in which he reviewed the business conditions in the country during the year, with particular emphasis on their relation to the file industry.—W. H. M.

MIDDLE ATLANTIC STATES

ROCHESTER, N. Y.

MARCH 1, 1926

Business activities have been well maintained in most plants during this month. In fact in some of the larger plants an increased output is noted. Brisk business in the various brass foundries about the city continues, there having been no recession since the middle of November. Brass founders say they cannot account for the present satisfactory conditions in the brass and copper trade unless it is because of the unusually heavy building program now prevailing in Rochester.

In the Lincoln Park district of the city manufacturers are going ahead with spring expansion. The plant of the **General Railway Signal Company** is very busy with large unfilled orders of railway equipment that will keep every department at full speed for months. The **Pfaudler Company,** too, is doing a larger business than early in the winter, and its prospects for spring are encouraging.

Normal business conditions prevail in the plant of the **Eastman Kodak Company,** but the invention of a new and cheap camera is expected to create renewed activity in certain branches of the company. The recent reorganization of the **Bausch & Lomb Optical Company** is expected to result in better business and a heavier output of optical products. It is said that the company's business suffered a decline last year.

Reports from the **Todd Protectograph** and **Stromberg Carlson Company** are very satisfactory, and indicate improved industrial conditions as spring approaches. Both concerns are enjoying a good business at this time.—G. B. E.

NEWARK, N. J.

MARCH 1, 1926

Pending the determination of an appeal, the Court of Errors and Appeals stayed the injunction and receivership proceedings instituted against the **Berry Automatic Lubricators Corporation,** of Newark, for which Vice Chancellor Backes appointed Samuel I. Kessler as temporary receiver, and enjoined the corporation from transacting business in New Jersey. The court directed that the corporation submit a bond of $5,000 to

secure the claims of the creditors. The concern was chartered in Delaware. At the time the vice chancellor appointed a receiver the court directed counsel to bring to the attention of the prosecutor and federal authorities all the information respecting the alleged fraudulent misrepresentation in the sale of stock. It is said the corporation sold stock to the amount of $140,000 in New York and Pennsylvania and paid $80,000 in commission.

Creditors of the **Adams, Morgan Company,** of Upper Montclair, N. J., may have to take the radio sets or parts which the company manufactures in part payment of their claims against the concern. This was indicated when Federal Judge Runyon made permanent the appointment of Charles A. Burris and Thomas W. Stephens as receivers. An order was issued to show cause why the creditors should not accept merchandise and radio parts at retail prices in part payment of their debts. The company manufacturers the Paragon radio receiving set.

Following Newark concerns were chartered here: **Newark Metal Coating and Litho Company,** $25,000; **Lafayette Electrical Producing Company,** electrical supplies, 1,000 shares; **Pennant Radio Laboratories, Inc.,** radio supplies, $100,000 capital; Hardester **Corporation,** chemicals, $100,000; **Woolf-Komholz,** Inc., jewelry, $100,000; **Woodside Plumbing and Heating Supplies Company,** plumbing supplies, $100,000; **Simplex Radio Devices, Inc.,** manufacture radio parts, 100 shares no par; **Cliff Plumbing Supply Company,** plumbing supplies, $25,000; **Mastertone Radio Corporation,** manufacture radio accessories, $125,000.—C. A. L.

TRENTON, N. J.

MARCH 1, 1926

Trenton metal manufacturers have every reason to believe that the coming spring and summer seasons will be prosperous ones. **William G. Wherry,** president of the **Skillman Hardware Manufacturing Company,** reports that there is already a heavy demand for all kinds of hardware and that this indicates there is prosperity ahead. The **Jonathan Bartley Crucible Company** is also doing a nice business at the present time, while the Jordan **L. Mott Company** continues to operate to capacity.

William G. Wherry, president of the Skillman Hardware Manufacturing Company, has been appointed chairman of the traffic bureau executive committee of the Trenton Chamber of Commerce.

Following concerns were chartered here during the past month: **Boissier Electric Corporation,** Newark, 2,500 shares, manufacture electric motors; **Bogart and Hansen, Inc.,** Montclair, N. J., $100,000 capital, manufacture electrical appliances; **Savage Appliance Corporation,** Trenton, N. J., manufacture electrical appliances, $50,000 capital; **Ambler & Van Heuvel, Inc.,** New Brunswick, N. J., manufacture radio supplies, $125,000 capital; **Newark Hardware Company,** Perth Amboy, N. J., deal in hardware, $125,000 capital; **Kell Manufacturing Company, Inc.,** Newark, N. J., manufacture tools, $30,000 capital; **Keystone Radio Company,** East Orange, N. J., radio supplies, $10,000 capital; **Waterside Chemical Corporation,** Jersey City, manufacture chemicals, 2,000 shares, no par value; **Arkay Supply Company,** Passaic, N. J., plumbing supplies; $100,000 capital; **Radiocompak Company,** Asbury Park, N. J., radio supplies, $100,000 capital.—C. A. L.

PITTSBURGH, PA.

MARCH 1, 1926

The metal industries in the Pittsburgh district and throughout Western Pennsylvania have shown a slow but healthy improvement during February, with the exception of a few spotty lines, which are passing through the dull season at this time of the year. Electrical equipment plants are operating at a fair rate. Plumbing supply dealers and manufacturers are busy, with a continued steady demand expected. The hardware trade is in moderate volume. Building material generally is inactive at this time, due to the dull season in building lines. Radio equipment lines are not quite so active as they have been.

Construction of a new machine plant at the **Robertshaw Thermostat Company,** at Youngwood, Pa., will give employment to 100 additional men, it has been announced. The factory is now running at capacity.

Orders have been placed for eight aluminum cars to be used in suburban traffic in the Philadelphia zone by the Pennsylvania Railroad. Each car is operated under its own power. The trucks and frames will be the same as now in service, but the metal used in place of steel in the superstructure will be 65 per cent lighter.

The week of Feb. 15 to 22, was "Let's know Pittsburgh" week, huge displays were in evidence throughout the city. One of the big features was a Lange motor truck, on display in the circle at the Pennsylvania Railroad (Union) station. Among the Pittsburgh concerns furnishing metals for the Lange truck follows:

Aluminum Company of America, castings; **Armstrong Cork Company,** cork gaskets; **Flynn, Wolfe Bronze Company,** bronze castings; **Liberty Mirror Works,** mirrors; **Macbeth Evans Company,** lamp reflectors; **McKenna-Horiz Manufacturing Company,** brass, bronze.—H. W. R.

MIDDLE WESTERN STATES

CLEVELAND, OHIO

MARCH 1, 1926

With the first two months of the new year brought to a close the metal industry in the Cleveland territory is in a stabilized condition. A report issued by the Cleveland Chamber of Commerce reveals a slight increase.

The **Glenn L. Martin Company** is filling a large order of all-metal airplanes for the United States Navy. The new ships are constructed with a new aluminum alloy. One rib of the plane, weighing 10½ ounces will support 791 pounds of distributed weight. One body strut will stand a compressure of 18,000 pounds. The new planes will have a cruising radius of 1,000 miles and when fully equipped for war purposes will weigh 9,000 pounds.

The **Ohio Brass Company's** salesmen from all parts of the world gathered in Mansfield last month for the annual business conference. Representatives from all parts of the United States, Canada, Cuba, Mexico, France and other foreign countries were present. Plans for expansion of the firm's export business were formulated. After inspecting the main plant in Mansfield, the salesmen spent two days at the insulator plant in Barberton.

By the recent order of distribution approved by Probate Judge Bostwick of Columbus, the **Batelle Memorial Institute** for the advanced study of metallurgy came into possession of stocks and bonds valued at $1,523,736. Half the amount is from the estate of the late Mrs. John Gordon Batelle, former Republican national committeewoman of Ohio. The order heavily endows the institute and will greatly increase the field of its researches.

In a statement recently issued in Cleveland, **Dr. Robert J. Anderson,** consulting metallurgical engineer and expert on aluminum pointed out that 1925 was the largest aluminum producing year ever attained in the United States. This nation accounts for more than 50 per cent of the world's output of 400,000,000 pounds, according to Dr. Anderson. Increased consumption in the electrical manufacturing industry and the automotive industry accounts for the records production, he says. The automotive industry used 50 per cent of the American output, electrical industry 10 per cent, general engineering trades 15 per cent, steel industry five per cent, cooking utensils 10 per cent and miscellaneous purposes such as aircraft, chemical plant equipment, paint, etc., 10 per cent.—S. D. I.

INDIANAPOLIS, IND.

MARCH 1, 1926

The **Indianapolis Plating Company** has moved its shop to 425 West Vermont street from 635 Kentucky avenue, Indianapolis.

Announcement is made by **W. J. Hagerty & Sons,** South

Bend, Ind., of the perfection of a metal polish which they claim is adaptable for all types of metal. This firm is marketing the polish as Hagerty's All-Metal polish that it will be manufactured in the company's plant.

The **Argos Foundry Company, Inc.,** has been incorporated at Argos, Ind., to manufacture iron, brass, aluminum and other metal products. The incorporators are John H. Miller, Mathilda Miller and George J. Miller.

The **May Brass and Foundry Company,** of Chicago, will move its plant to Ladoga, Ind., as soon as it is possible to complete arrangements.—E. B.

DETROIT, MICH.

MARCH 1, 1926.

It is announced that the **Sheet Aluminum Corporation** will move to Jackson and begin operations soon in the plant formerly occupied by the Potter Manufacturing Company. It is stated that 200 men will be employed with operations on a two-hour basis. The company already has spent $350,000 equipping its Jackson factory with rolling mill and other machinery equipment. The factory has a floor space of 36,000 square feet. This company will be the only one in Jackson manufacturing a basic material. In the process of manufacture, aluminum ingots are transformed into sheets and moulders through rolling and cutting. This product is sold to other concerns for fabrication into various articles and utensils. John A. Lang, of Jackson, is president; W. J. Moore, Detroit, vice-president; and A. T. Jones, secretary and treasurer. The sales office will be located in Detroit and will be in charge of Mr. Moore.

"Skillful use of the cheapest and most easily handled materials and the attainment of useful results with them mark the highest achievement of engineering," declared **H. L. Horning,** in his presidential review of the past year's activities of the **Society of Automotive Engineers,** at the annual meeting of the society in Detroit recently. "Ten years ago, except in the very cheapest of products, new car models always had aluminum crankshafts and transmission cases," he said. "Today, the use of aluminum is the exception. There never was a time when engineers valued more highly aluminum of the lighter alloys, or desired more to use them. The market price, however, is quietly restricting, if not eliminating, aluminum as an automobile material. Except in the cases of the most expensive cars, and the most specialized purposes, it is disappearing on the automobile. In the meantime, new grey irons are being developed whose tensile strength, elastic limit and wearing qualities have reached remarkable values. The automobile industry has developed grey iron castings from a condition of an uncertain art to that of a truly scientific achievement. The uses of grey iron are increasing, together with a reduction of prices."

"Foundry work," states Albert U. Widman, works manager of the **Cadillac Motor Car Company,** "in which definite improvements in manufacturing methods figure prominently, is one of the chief reasons why high-class motor cars can be sold so much more cheaply now than they could a few years ago. The complete standardization of parts and the elimination of hand fitting, demand an entirely new standard of accuracy, which had previously been unknown in foundry practices. For the sake of economy, most of the heavy manual work has been eliminated. Conveyers for sand, molten metal and castings same time and labor. In the Cadillac foundries, for instance, the operation of pouring the cylinder molds is now done by one man in a conveyer cab, with one helper—an operation which originally required 19 men.

"Studies of metallurgy have accomplished two big results—the discovery of metals better adapted to definite uses, and more economical methods for producing definite results. The science of metallurgy has been completely revolutionized during the last seven years and it owes its greatest impetus to the requirements of a vehicle which must travel over every kind of a road under all climatic conditions."—F. J. H.

CHICAGO, ILL.

MARCH 1, 1926.

The **Metal Door & Trim Company,** 306 South Michigan avenue, have been capitalized for $618,000 to manufacture and deal in hollow metal trim, bronze and aluminum. The incorporators are John D. Peterson, Willard A. Pease, William U. Bardwell. The correspondents are Wetten, Pegler and Dale, 108 South La Salle street.

The **U. S. Supply Company,** 1214 Grand avenue, has been capitalized for $1,100. They will manufacture and deal in automobile supplies and accessories. H. H. Allen, R. C. McCabe, H. G. McCabe are the incorporators. Linaweaver & Linaweaver, 77 West Washington street, are the correspondents.

The **Swanfeld Metal Lath Corporation,** 818 East Fifty-seventh street, has been caitalized for $100,000. They will manufacture appliances of every kind and description. Curtis W. Catron is the correspondent. The incorporators include Theodore J. Nelson, John M. Swanson and William R. Donisch.

The **Kne-Koster Company,** 2915 South Wabash avenue, is capitalized for $20,000 and 500 shares non par value. They will manufacture metal toys, slides, wheel goods and knekosters. The incorporators include Stanley J. Petit, Edward F. Hamm and Harry A. Dunham. Simon J. Harbaugh is the correspondent. His office is in the Otis Building.

The **Allied Industrial Products Company** has acquired the four-story building, 60 by 115 feet, at 120-26 North May street. The purchaser, now at 1115 West Washington boulevard, will occupy the property and plans the addition of two stories.

The **Greenpoint Metallic Bed Company,** with main plant in Brooklyn, N. Y., has leased the third floor of building at 358 West Ontario street. The company will utilize its present space at 16th and Clark streets for a warehouse.—J. H. G.

OTHER COUNTRIES

BIRMINGHAM, ENGLAND

FEBRUARY 16, 1926.

Metal products occupy a large space at the British Industries Fair, opened at Castle Bromwich, near Birmingham, on Monday, Feb. 15, and will remain open for a fortnight. Brassfoundry, hardware and ironmongery will have an imposing show, and 80 firms are exhibiting electrical plant accessories and other equipment. Metals figure prominently in the display of heating, power and lighting plant exhibited by about 200 firms. The manufacture of electrical and wireless accessories is rapidly becoming a staple industry in Birmingham, scores of factories and depots having been added within the last twelve months.

The year has opened rather quietly in connection with the copper and tube trades. Some of the largest merchants complain that this has been the worst January for some years. Financial stresses on the Continent are largely responsible, and South America has been slower than usual in coming forward with orders for copper and brass tubes. German competition has been very keen lately, one feature being the general abandonment of charges for extras.

By way of exception the firms specializing on cupro-nickel tubes are busier than for a long time past, and leading works have several months work on hand.

The galvanized hollow ware trade has shown a little improvement since the beginning of the year with increasing orders from India, South Africa and America. The keenness of foreign competition, however, prevents any liberties being taken with the price.

The year has opened very favorably for shipbuilding, more orders having been placed within the last ten days than for some months past, including some very powerful motor vessels, and Birmingham expects to benefit by the receipt, later, of orders for fittings, especially for the big liners. There is a marked increase in demand for these high-class fitments on which the Birmingham brass trades have specialized for many years past.

The vigorous propaganda carried out by Birmingham brass manufacturers having for its object the substitution of copper tubes for those of lead for water conveyance has brought its reward in a rapidly extending business.

Another trade in which non-ferrous materials are used is that of railway lamp construction. Copper is being more generally used for hearth furniture, largely on account of its susceptibility to artistic embellishment, its generally better appearance, and less liability to rust.

The Jewelers' Trade Protection Society of Birmingham has held a conference to discuss a publicity campaign to re-popularize the wearing of jewelry. For some years past the amount of jewelry worn has been steadily on the decrease, with disastrous results to many Birmingham factories. It is proposed to utilize to the fullest extent various forms of publicity.

Several technical societies in the neighborhood of Birmingham are holding informal consultations with a view to testing the possibility of amalgamation. A special committee representative of the Birmingham Local Section of the Institute of Metals, the Birmingham Metallurgical Society and the Staffordshire Iron and Steel Institute have nominated members to a committee to collect facts, and consider whether it may be possible to combine the membership of two or more of the societies having kindred interests, with the payment of a single subscription. Attendance at meetings are somewhat unsatisfactory, and it is thought that an additional attraction will be offered if members can attend one or all of the three societies. —J. H.

Business Items—Verified

The New York office of **Raymond Bros. Impact Pulverizer Company** has been removed from 43 Broad street to 342 Madison avenue. S. B. Kanowitz, Eastern manager, will be located at this new address.

The corporate name and style of the **Meaker Galvanizing Company,** 1243 Fulton street, Chicago, Ill., has been changed to the **Meaker Company.** The address, personnel and organization of the company remain the same.

Tulsa Brass Casting Company, Tulsa, Okla., recently organized, has acquired a local building for its proposed foundry, 40 x 42 ft., and will install molding equipment, sand blast apparatus, air compressor and auxiliary equipment.

The **Stanley Works,** New Britain, Conn., have installed hydro-electric power to replace steam power in their plant. The **Farmington River Power Company,** a subsidiary, will supply power to the Stanley Works and the **Stanley Rule and Level** plant.

A fire, caused by an explosion in the plant of the **Standard Underground Cable Company,** Perth Amboy, N. J., on March 2, 1926, is said to have damaged the plant to the extent of $250,000. The plant is one of the largest of its kind in the world, having a night force of 1,200 men.

The **Copper & Brass Research Association** of 25 Broadway, New York City, announces the membership of the Baltimore Tube Company, of Baltimore, Md. This company was organized in 1912 for the manufacture of seamless brass and copper tubing, and in 1919 its present rolling mill unit was completed.

J. F. Coxan, Wooster, Ohio, operating a local plant for the manufacture of electric and art illuminating fixtures, is arranging for an addition. Negotiations are being concluded with the board of trade for the erection of a new building, the present plant to be removed to the structure and additional machinery installed.

The **Voos Company,** Porter street, New Haven, Conn., manufacturer of cutlery, etc., has awarded a general contract to the National Construction Company, 151 Court street, for its two-story addition, 35 x 44 ft., for which D. E. Smith, New Haven, is architect. This firm operates the following departments: tool room, grinding room, plating, japanning, stamping, polishing, lacquering.

The **Diamond Power Specialty Corporation,** manufacturer of Diamond soot blowers, announces the appointment of J. E. Heeter as manager of the Philadelphia office. Mr. Heeter succeeds M. J. Miller, who has been transferred to the Detroit territory. Mr. Heeter has been associated with Mr. Miller in the Philadelphia district for many years and well versed in soot blower engineering and soot blower service work.

Henry Disston & Sons, Inc., of Philadelphia, Pa., announce the appointment of E. A. C. Baum as assistant Western representative for steel sales, with headquarters at the Disston Chicago branch, 111 North Jefferson street. Mr. Baum formerly was metallurgical engineer with the Illinois Tool Company, and comes into the sales field after many years of experience in the handling and use of tools and tool steels.

The **Allied Industrial Products Company,** formerly of 1115-17 Washington Boulevard, Chicago, Ill., has purchased a building which will be known as the Pyramid Building at 120 to 126 No. May street, Chicago. The Allied Industrial Products Company, formed in 1923, is one of the largest distributors of California and Italian lump pumice stone and is the manufacturer of Dred Naut oil remover; also distributors platers' supplies to the metal industry.

At the annual meeting of the stockholders of the **Northern Engineering Works,** manufacturers of electric traveling cranes, electric hoists and foundry equipment, Detroit, Mich., the following officers and directors were elected for the ensuing year: Henry W. Standart, president and treasurer; Harry C. Bulkley, vice-president; Louis H. Olfs, secretary. The above, with W. Robertson, chief engineer of the company, and Joel H. Prescott, constitute the board of directors.

The **Adams Grease Gun Corporation,** 329 Fifth avenue, New York, manufacturer of high pressure lubricating systems, guns and machinery, is in the market for die castings of zinc alloys, brass castings, parts of brass forgings, screw machine parts, and a number of steel products. This company manufactures a hydraulic high-pressure lubricating device for automobiles, trucks, tractors, industrial machinery, etc. **Daniel G. Adams** is president. The capital stock of the company will soon be increased to provide additional funds for expansion.

Following a fire on December 16, 1925, which completely destroyed its former building and entire contents, the **Colonial Silver Company, Inc.,** Portland, Me., is now located in a new building at 252 Spring street, Portland, Me. Entirely new equipment of the latest type for the manufacture of high grade plated hollow ware has been installed, and operations will resume about April first. **A. G. Jerome,** formerly head plater for the Gorham Company, Providence, R. I., and for 33 years connected with that institution has been secured to take charge of the plating department.

The **Dirigold Corporation,** Minneapolis, Minn., manufacturer of jewelry novelties and Dirigold fixtures for industrial use, will make arrangements to acquire or build manufacturing quarters in Minneapolis in the Spring. The following directors were re-elected at a recent meeting, O. Von Malmberg, Carl Von Malmberg, A. G. Krans, Charles J. Andre and Ernest P. Lindquist. This firm operates the following departments: smelting and refining, brass, bronze and aluminum foundry, tool room, grinding room, casting shop, cutting-up shop, spinning, brazing, rolling mill, stamping, soldering, polishing, lacquering, machine shop.

Negotiations have been completed for the acquisition by the **Ajax Electrothermic Corporation,** Trenton, N. J., of a 25-acre tract of land in Ewing Township, and as soon as title to the property can be passed, construction of a large plant and office building will be begun. Costing the concern about $25,000, the land is situated at the junction of Fernwood Road and the Reading Railroad Company's tracks. Plans call for the erection of a factory 200 x 60 ft., together with a two-floor office building, containing about 4,000 sq. ft. of floor space. It is expected that the buildings and equipment will cost between $60,000 and $80,000.

Industrial and Financial News

INCORPORATIONS

American Foundry Equipment Company, 366 Madison avenue, New York, has changed its charter, incorporating in Delaware, and relinquishing the Ohio charter.

The **Kentucky Metal Products Company,** Louisville, Ky., has been incorporated with a capital of $10,000. Incorporators are: H. L. Covert, J. W. Covert and **F. J. Helm. This firm** will operate the following departments: Plating, japanning, polishing, lacquering.

The **Hayward Manufacturing Company,** 780 Union street, Brooklyn, N. Y., contract manufacturer of screw machine parts and bronze castings, has been changed from a partnership to a corporation, with capital stock of $50,000. The company has been in business as a partnership for two and a half years and no changes are contemplated in the character of the business as it has been conducted. This firm operates a brass machine shop.

The **Accurate Metal Stamping Company** is a new corporation formed by A. A. Buehring, president, and W. E. Bewley, vice-president and secretary, with headquarters at 136 Liberty street, New York. It will engage in the blanking, forming and assembling of the lighter forms of metal stampings. A factory has been secured in Brooklyn and new equipment is now being installed. Mr. Buehring, an experienced production engineer, was recently with the Consolidated Machine Tool Company, and Mr. Bewley was formerly a member of the Dale Machinery Company, Chicago, Ill.

BRITISH INDUSTRIES FAIR

At the British Industri s Fair recently held in Birmingham, England, a number of exhibits were shown of interest to metal manufacturers and users. Among those exhibiting were the following:

Gibbons Bros., Ltd., Dudley, England. Annealing furnace; electric charging machine; refractories.

W. & T. Avery, Ltd., Birmingham, England. Testing machines.

Cambridge Scientific Instrument Company, Cambridge, England. Corrosion testing apparatus.

T. J. Priestman, Birmingham, England. Alloys of all descriptions.

W. Canning & Company, Ltd., Birmingham, England. Electro-plating and finishing equipment.

Brooks & Adams, Ltd., Birmingham, England. Hot pressings and stampings.

Suttcliffe, Speakman & Company, Leigh, Lancaster, England. Ingots and hot pressings of various alloys.

Britannia Tube Company, Ltd. Tubes for hardware industries.

Earle, Bourne & Company, Ltd., Birmingham, England. Copper and brass tubes; cold rolled copper and brass.

Delta Metal Company, Ltd., Birmingham, England. Copper, brass, bronze and Delta alloys in large variety of products.

Extruded Metals Company, Ltd., Birmingham, England. Extruded metals.

Bowen Instrument Company, Leeds, England. Pyrometers.

Diecastings, Ltd., Birmingham, England. Diecastings in aluminum alloys.

Radiation, Ltd., Birmingham, England. Gas fired furnaces.

Association of Drop Forgers and Stampers. Brass, bronze and Monel metal stampings and drop-forgings.

Holden & Hunt, Old Hill, Staffordshire, England. Electric welding.

Timmins & Company, Stourbridge, England. Refractories.

Serck Tubes, Ltd., Birmingham, England. Small tubing in various metals.

Zinc Alloy Rust-Proofing Company, Wolverhampton, England. Sherardized products.

TELEPHONE AND TELEGRAPH PROGRESS

The 1926 construction program of the Long Lines Department, Amberican Telephone and Telegraph Company, contemplates plant construction to cost more than $28,000,000. Plant costing approximately $19,000,000 was constructed in 1925, which was a record at that time.

The proposed expenditures for plant construction during 1926 are divided among various projects about as follows:

Aerial wire, including new pole lines	$5,160,000
Long distance cables with associated pole lines, loading coils, buildings and equipment	11,200,000
Switchboards and other telephone and telegraph equipment	8,130,000
Line work not included in the aerial wire and cable projects	3,860,000

The new facilities will provide for increases in long distance telephone traffic and will also make it possible to furnish more dependable and faster service. Large quantities of copper and other metals will of course be used in this construction.

WIRE AND SHEET METAL GAUGES

The American Engineering Standards Committee, 29 W. 39 Street, New York, has been requested by the Society of Automotive Engineers to take up the unification of wire and sheet metal gauge systems in order to arrive at a national standard system of designating the diameters of metal wires and the thickness of metal sheets. The systems of gauge numbers by which these products are generally designated at present have been developed and adopted in the course of time in different trades and for different products, as steel and copper wire, aluminum, brass and zinc sheets, etc. In the request submitted by the Society of Automotive Engineers there are listed 13 gauge systems now in use in this country.

A conference of all industrial groups interested in this problem will be called in the near future, to discuss the desirability and possibility of unifying the various existing gauge systems into a consistent national system, or systems.

Any suggestions with regard to the general technical problem, or any of its phases, will be welcomed by the American Engineering Standards Committee.

NICKEL COMPANY REPORT

The International Nickel Company, New York, reports a gross income of $6,528,100 for nine months ending December 31, 1926, as against $4,914,289 for the entire fiscal year ending March 31, 1925. After all deductions the company shows a net profit of $4,327,400 for nine months which was equal, after preferred dividends, to $2.69 per share of common stock, as compared with net profit of $1.43 per share for the whole previous year.

METAL STOCK MARKET QUOTATIONS

	Par	Bid	Asked
Aluminum Company of America	...	$ 68	$ 72
American Hardware Corporation	$100	89	92
Anaconda Copper	50	44	44½
Bristol Brass	25	7	9
International Nickel, com	25	35¾	36
International Nickel, pfd	100	102	...
International Silver, com	100	104	107
International Silver, pfd	100	104	107
National Enameling & Stamping	100	28½	29½
National Lead Company, com	100	153	154½
National Lead Company, pfd	100	116	117
New Jersey Zinc	100	193	196
Rome Brass & Copper	100	130	138
Scovill Manufacturing Company	...	225	235
Yale & Towne Mfg. Company, new	...	61½	63½

Corrected by J. K. Rice, Jr., Co., 120 Broadway, New York.

Review of the Wrought Metal Business

Written for The Metal Industry by J. J. WHITEHEAD, President, Whitehead Metal Products Company of N. Y., Inc.

MARCH 1, 1926.

From the comments made by some of the manufacturers of metals in the form of rods, sheets, tubes and wire, it would appear that the volume of business placed in February was satisfactory to them. There was a continued steady demand with unfilled orders at the close of February standing at about the same high level as that which prevailed at the close of January. This condition is all the more pleasing because of the fact that the materials which are being bought are practically all going into immediate consumption.

For sometime past the condition of the market has been such as to discourage buying for speculation, with the result that this feature has been almost entirely eliminated, and orders which are being placed are for actual requirements. The same conditions which have removed this speculative buying from the market have also been responsible for the development of a tendency on the part of buyers to avoid the accumulation of any large stocks. Although most of the mills have on their books a volume of business in excess of anything which they have enjoyed since the war, the productive capacity is so enormous that it has been possible to make deliveries with a fair degree of promptness. Coupled with this, is the fact that the larger jobbers have expanded their stocks to cover a wide range of sizes and variety of material for supplying the needs of the consumer, and these jobbers are quoting prices which represent very little, if any, advance over the prices asked by the mills.

Under these conditions, the consumer has found that there is no money to be made by him in tying up capital in raw material when both the mills and the jobbers have cooperated to such an extent as to make it possible for him to procure very promptly, such material as he needs.

One of the interesting events which occurred during the month was the placing of an order for several hundred thousand pounds of brass pipe for installation in the new Statler Hotel in Boston. There was considerable competition for this order which finally went to one of the Connecticut mills. Also, following a policy outlined several months ago, a real estate syndicate owning and controlling about fifteen very large apartment houses in New York placed contracts for the complete renovation of the plumbing in several of their houses, in which the iron pipe which was originally installed is all being torn out and replaced by brass pipe.

In spite of the large demand, however, for brass and copper for plumbing, the competition for orders has been very keen, especially as to brass pipe, and the prices which are being quoted are without doubt much more satisfactory to the consumer than they are to the producers.

The demand for white metal still continues to be heavy and producers of nickel and nickel copper alloys such as Monel metal and nickel silver all report their business to be in prosperous condition.

In the new Palmer House which has just opened in Chicago the amount of Monel metal installed in the various departments in all kinds of equipment reaches the astonishing total of one hundred and thirty-six thousand pounds. Several new restaurants are being opened by Schrafft's in all of which Monel metal will be used exclusively throughout the kitchens and serving rooms. All of the mills manufacturing these products are running full, and deliveries are rather badly delayed.

There is a certain note of caution observed on the part of both manufacturers and consumers, but as yet there is nothing in sight to indicate any slowing down in activity throughout the industry.

Metal Market Review

Written for The Metal Industry by R. J. HOUSTON, of D. Houston & Company, Inc., Metal Brokers, New York

MARCH 1, 1926.

COPPER

The February opening of the copper market was on the basis of 14 cents, but the early transactions were followed by a more general demand and a marking up of prices to 14¼c. @ 14⅜c. for domestic deliveries. Trading broadened out to important dimensions as the market strengthened. Consumers and exporters took a more optimistic view of the outlook, and for the time being at all events followed the trend of the market by placing substantial orders.

Interest centered in the announcement of a plan for a new and more important copper export association under the Webb-Pomerene law. The drafting of a plan has been prepared for adoption by the various copper companies in the combination which is to conform in practical application to Government requirements. If the proposal receives the sanction of the Washington authorities it will undoubtedly prove a constructive and favorable factor for the industry. The more forward-looking and conservative group in the copper trade sees the necessity for a stabilizing influence in both the domestic and foreign markets.

There was an increase of 17,334,000 pounds in refined stocks of copper during January.

ZINC

The market for zinc lost ground during February. On the whole, the domestic consumption is maintained at fair volume. The domestic takings in January amounted to 51,142 tons, or 1,253 tons more than in December. Exports in January, however, dwindled to 242 tons, against an average of 5,400 tons monthly in 1925. The big decline in foreign shipments and the heavy production in January of 56,389 tons resulted in an increase of stock in smelters' hands on January 31 of 5,005 tons. Surplus stocks on that date were 14,300 tons, being the largest in five months.

The foreign situation has been under the influence of liberal offers by Germany and heavy shipments from that country into England. It is evident that consuming demand in Germany and the Continent will have to show decided improvement before the clearings from this country resume their former bulk. United States exports of metallic zinc in 1925 amounted to 76,350 tons as against 72,583 tons in 1924. The market is easy at 7.50c. East St. Louis and about 7.80c. @ 7.90c. New York.

TIN

Heavy American consumption of tin, scarcity of spot stocks, and a world demand running ahead of supplies have been steadily growing factors in the market situation. Prices in February climbed to 64⅜c. @ 64½c. for prompt Straits. The present level compares with an average price of 57.08 cents for February, 1925.

All statistical data furnishes ample ground for the underlying strength of the market and the vigorous movements of the last few weeks. The highly erratic character of the tin market, however, naturally suggests caution until more normal conditions prevail. Higher prices may result, provided consumption shows further expansion, but a pronounced setback in business would necessarily force new market adjustments and cause more than a ripple in prices. The situation, however, is tense and sensitive and capable of becoming more so. Market tone is firm, with 64½c. bid for spot Straits. Future shipments quote less.

LEAD

Trade in lead was less active recently and prices have receded to 8.65c. @ 8.75c. in the St. Louis market and 9 cents for New York delivery. Shipments into consumption continue good, however, and the outlook seems propitious for satisfactory distributions of supplies to the consuming industries during the spring months. Stocks are not considered heavy, but buyers are inclined to move leisurely in placing orders for future requirements. An

easier market tone is consequently apparent and some holders were inclined to make slight concessions to attract buyers.

The production of refined and antimonial lead in the United States in January amounted to 71,493 tons, against 66,626 tons in December. The average monthly production in 1925 was 64,322 tons, and in 1924 the average monthly rate was 59,051 tons.

ALUMINUM

Market strength is maintained for aluminum. Conditions and trade methods all contribute to give stability to this commodity. Heavy consumption and a growing demand continue to be favorable factors. Fluctuations in price are therefore practically nil or so small as to carry little or no weight in trade circles. Supplies have found ready sale at 28c. for 99% plus and 27c. for 98-99% grade of metal. Demand has been active, and the indications are that it will grow more pronounced as the year progresses. Producers appear to be satisfied with present prices. Imports have been in good volume recently, but they are well absorbed without making any unfavorable impression on the market. The aluminum industry is established on a highly profitable basis and is operated first and last as a profit-making enterprise.

ANTIMONY

Antimony showed a fair degree of activity recently for shipment from China over the first quarter of this year. Prices have receded from the high level obtainable at beginning of the year, but on present basis of 21 cents for spot regulus, duty paid, demand is limited and the market quiet. With restricted Chinese supplies the undertone is sensitive to any shift in values due to the position holders take regarding material afloat or for shipment. Domestic consumption is on a good scale, offerings are conservative, and production is not likely to show pronounced increase in the immediate future. Prices are abnormally high, however, and the market is open to irregularities until supplies show a substantial increase.

QUICKSILVER

The tone of market for Quicksilver is firmer at $89 per flask. Consumption is at a fair rate and with less pressure to sell buyers are taking supplies at current prices.

PLATINUM

Supplies were on a larger scale and price for refined platinum has receded to $108 per ounce. New sources of supply are reported on Canadian territory, and output is increasing in other quarters.

SILVER

There has been a gradual loss of tone to the market for silver, and bullion values have declined to 66¼ cents in the local market. General scattered buying has followed the downward course of prices, but sellers have been ready to meet demand as it developed. There is evidence of further efforts to get the Government to purchase from mines of the United States 14,589,730 ounces of fine silver at $1.00 an ounce to complete the purchases of silver authorized under the Pittman Act. The general market needs the stimulus of more aggressive buying to change its present trend.

OLD METALS

The present situation in old metals reflects the easing off in the primary markets. Scrap copper, brass and lead are all reported at lower figures. Trading is less active than a few weeks ago when the markets for new material were firm and buyers eager to place orders. The weaker and unsettled conditions may be only temporary, but the repeated London declines have depressed the domestic situation for all grades of copper and brass scraps. Foreign inquiries have appeared lately, but European ideas were too bearish to be in line with the local market. New York dealers quote buying basis of about 11¾c. for heavy copper, 9¾c. for light copper, 9¼c. @ 9½c. for new brass clippings, 6c. @ 6¼c. for light brass, 7c. @ 7¼c. for heavy brass, 7¼c. @ 7½c. for heavy lead, 4¼c. @ 4½c. for old zinc, and 21½c. @ 22c. for aluminum clippings.

WATERBURY AVERAGE

Lake Copper—Average for 1925, 14.427—January, 1926, 14.25c—February, 14⅜c.

Brass Mill Zinc—Average for 1925, 8.263—January, 1926, 9.00c—February, 8.20c.

Daily Metal Prices for the Month of February, 1926

Record of Daily, Highest, Lowest and Average Prices and the Customs Duties

	1	2	3	4	5	8	9	10	11	*12	15	16
Copper (f. o. b. Ref.) c/lb. Duty Free...												
Lake (Delivered)	14.125	14.125	14.25	14.375	14.50	14.50	14.50	14.50	14.50	.....	14.50	14.50
Electrolytic	13.90	13.95	14.05	14.25	14.30	14.20	14.20	14.25	14.25	.....	14.20	14.15
Casting	13.40	13.45	13.55	13.75	13.75	13.70	13.65	13.75	13.70	.....	13.70	13.60
Zinc (f. o. b. St. L.) c/lb. Duty 1¾c/lb.												
Prime Western	8.10	8.10	8.10	8.10	8.10	8.10	8.10	7.90	7.80	.....	7.80	7.65
Brass Special	8.20	8.15	8.15	8.20	8.20	8.20	8.20	8.05	7.95	.....	7.95	7.80
Tin (f. o. b., N. Y.) c/lb. Duty Free...												
Straits	62.00	62.00	62.25	63.00	63.25	63.25	63.50	64.00	63.75	.....	64.375	64.25
Pig 99%	61.00	61.00	61.25	62.00	62.25	62.375	62.25	63.00	62.75	.....	63.125	63.00
Lead (f. o. b. St. L.) c/lb. Duty 2½c/lb.	9.15	9.15	9.15	9.15	9.15	9.15	9.15	9.15	9.10	.....	9.10	9.00
Aluminum c/lb. Duty 5c/lb.	28	28	28	28	28	28	28	28	28	.....	28	28
Nickel c/lb. Duty 3c/lb												
Ingot	35	35	35	35	35	35	35	35	35	.....	35	35
Shot	36	36	36	36	36	36	36	36	36	.....	36	36
Electrolytic	39	39	39	39	39	39	39	39	39	.....	39	39
Antimony (J. & Ch.) c/lb. Duty 2c/lb.	22	22	22	22	22	22	22	22	22	.....	22	22
Silver c/oz. Troy Duty Free	67.00	67.25	67.125	67.00	66.875	67.00	67.125	67.00	66.875	.....	66.75	66.75
Platinum $/oz. Troy Duty Free	114.5	114.5	114.5	114.5	114.5	114.5	114.5	114.5	114.5	.....	114.5	114.5

	17	18	19	*22	23	24	25	26	High	Low	Aver.
Copper (f. o. b. Ref.) c/lb. Duty Free...											
Lake (Delivered)	14.50	14.50	14.50	.....	14.50	14.50	14.50	14.375	14.50	14.125	14.431
Electrolytic	14.10	14.10	14.10	.....	14.20	14.15	14.15	14.10	14.25	13.90	14.144
Casting	13.60	13.60	13.60	.....	13.65	13.65	13.65	13.60	13.75	13.40	13.630
Zinc (f. o. b. St. L.) c/lb. Duty 1¾c/lb.											
Prime Western	7.55	7.50	7.60	.....	7.75	7.80	7.85	7.70	8.20	7.70	7.958
Brass Special	7.65	7.60	7.65	.....	7.85	7.90	7.85	7.70	8.20	7.70	7.958
Tin (f. o. b., N. Y.) c/lb. Duty Free...											
Straits	64.00	64.25	64.25	.....	64.50	64.25	64.00	64.25	64.50	62.00	63.618
Pig 99%	62.75	63.125	63.125	.....	63.50	63.25	63.00	63.25	63.50	61.00	62.555
Lead (f. o. b. St. L.) c/lb. Duty 2½c/lb.	9.00	8.95	8.95	.....	8.90	8.90	8.80	8.80	9.15	8.80	9.039
Aluminum c/lb. Duty 5c/lb.	28	28	28	.....	28	28	28	28	28	28	28
Nickel c/lb. Duty 3c/lb											
Ingot	35	35	35	.....	35	35	35	35	35	35	35
Shot	36	36	36	.....	36	36	36	36	36	36	36
Electrolytic	39	39	39	.....	39	39	39	39	39	39	39
Antimony (J. & Ch.) c/lb. Duty 2c/lb.	22	21.75	21.50	.....	21.50	21.50	21.00	21.00	22.00	21.00	21.792
Silver c/oz. Troy Duty Free	66.625	66.50	66.75	.....	66.50	66.50	66.625	66.25	67.25	66.25	66.806
Platinum $/oz. Troy Duty Free	114.5	110.00	108	.....	108	108	108	108	114.5	108	112.44

* Holiday.

Metal Prices, March 5, 1926

NEW METALS

Copper: Lake, 14.375. Electrolytic, 14.10. Casting, 13.55
Zinc: Prime Western, 7.50. Brass Special, 7.60.
Tin; Straits, 64.00. Pig, 99%, 63.00.
Lead; 8.50. **Aluminum,** 28.00. **Antimony,** 20.00.
Nickel; Ingot, 35. Shot, 36. Elec. 39. Pellets cobalt free, 40.
Quicksilver, flask, 75 lbs., $88.50. **Bismuth,** $2.70 to $2.75.
Cadmium, 60. **Cobalt,** 97%, $2.60. **Silver,** oz., Troy, 66.00.
Gold, oz., Troy, $20.67. **Platinum,** oz., Troy, $109.00.

INGOT METALS AND ALLOYS

Brass Ingots, Yellow	10¾to11¾
Brass Ingots, Red	11¾to12¾
Bronze Ingots	11¾to12¾
Casting Aluminum Alloys	21 to24
Manganese Bronze Castings	23 to41
Manganese Bronze Ingots	13 to17
Manganese Bronze Forging	34 to42
Manganese Copper, 30%	28 to45
Monel Metal Shot	32
Monel Metal Blocks	32
Parsons Manganese Bronze Ingots	18¼to19¾
Phosphor Bronze	24 to30
Phosphor Copper, guaranteed 15%	18⅞to22½
Phosphor Copper, guaranteed 10%	18 to21½
Phosphor Tin, guaranteed 5%	70 to80
Phosphor Tin, no guarantee	65 to75
Silicon Copper, 10% ....according to quantity...	28 to35

OLD METALS

Buying Prices		Selling Prices
12 to12¼	Heavy Cut Copper	13¼to13¾
11¾to12	Copper Wire	13 to13½
10¼to10½	Light Copper	11¼to11¾
9¼to 9½	Heavy Machine Comp.	10¾to11¼
8 to 8¼	Heavy Brass	9¼to 9½
7 to 7¼	Light Brass	8 to 8½
8 to 8½	No. 1 Yellow Brass Turnings	10 to10½
8¾to 9¼	No. 1 Comp. Turnings	10½to11
8 to 8¼	Heavy Lead	8¾to 9
5 to 5¼	Zinc Scrap	6 to 6½
12 to13	Scrap Aluminum Turnings	15 to17
19 to20	Scrap Aluminum, cast alloyed	21 to22
22½to23	Scrap Aluminum, sheet (new)	24 to25½
38 to40	No. 1 Pewter	42 to44
12	Old Nickel anodes	14
18	Old Nickel	20

Wrought Metals and Alloys

COPPER SHEET

Mill shipments (hot rolled) ..... 21¾c. to 22¾c. net base
From stock ..... 22¾c. to 23¾c. net base

BARE COPPER WIRE

16¼c. to 16⅜c. net base, in carload lots.

COPPER SEAMLESS TUBING

24½c. to 25½c. net base.

SOLDERING COPPERS

300 lbs. and over in one order ..... 21¼c. net base
100 lbs. to 200 lbs. in one order ..... 21¾c. net base

ZINC SHEET

Duty, sheet, 15% Cents per lb.
Carload lots, standard sizes and gauges, at mill, less
8 per cent discount ..... 12.00 net base
Casks, jobbers' price ..... 13.25 net base
Open Casks, jobbers' price ..... 13.75 to 14.00 net base

ALUMINUM SHEET AND COIL

Aluminum sheet, 18 ga., base price ..... 40c.
Aluminum coils, 24 ga., base price ..... 36.70c.
Foreign ..... 40c.

ROLLED NICKEL SHEET AND ROD

Net Base Prices

Cold Drawn Rods	58c.	Cold Rolled Sheet	60c.
Hot Rolled Rods	50c.	Hot Rolled Sheet	52c.

BLOCK TIN SHEET

Block Tin Sheet—18" wide or less. No. 26 B. & S. Gauge or thicker, 100 lbs. or more, 10c or over Pig Tin; 50 to 100 lbs., 15c. over; 25 to 50 lbs., 17c. over; less than 25 lbs., 25c. over.

SILVER SHEET

Rolled sterling silver, 66¾ to 68¾c.

BRASS MATERIAL—MILL SHIPMENTS

In effect February 4, 1926
To customers who buy 5,000 lbs. or more in one order.

	Net base per lb. High Brass	Low Brass	Bronze
Sheet	$0.19⅛	$0.20⅝	$0.22¾
Wire	.19⅝	.21⅛	.23⅛
Rod	.16⅞	.21⅜	.23⅜
Brazed tubing	.27⅛	.....	.32⅜
Open seam tubing	.27⅛	.....	.32⅜
Angles and channels	.30⅛	.....	.35¾

For less than 5,000 lbs. add 1c. per lb. to above prices.

BRASS SEAMLESS TUBING

23¾c. to 24¾c. net base.

TOBIN BRONZE AND MUNTZ METAL

Tobin Bronze Rod ..... 21⅛c. net base
Muntz or Yellow Metal Sheathing (14"x48") .. 19⅛c. net base
Muntz or Yellow Rectangular sheet other Sheathing ..... 20⅛c. net base
Muntz or Yellow Metal Rod ..... 17⅛c. net base
Above are for 100 lbs. or more in one order.

NICKEL SILVER (NICKELENE)

Net Base Prices

Grade "A" Sheet Metal		Wire and Rod	
10% Quality	27c.	10% Quality	30c.
15% "	28½c.	15% "	33¾c.
18% "	29¾c.	18% "	37c.

MONEL METAL SHEET AND ROD

Hot Rolled Rods (base)	35	Hot Rolled Sheets (base)	42
Cold Drawn Rods (base)	43	Cold Rolled Sheets (base)	50

BRITANNIA METAL SHEET

No. 1 Britannia—18" wide or less, No. 26 B. & S. Gauge or thicker, 500 lbs. or over, 8c. over N. Y. tin price; 100 lbs. to 500 lbs., 10c. over; 50 to 100 lbs., 15c. over; 25 to 50 lbs., 20c. over; less than 25 lbs., 25c. over. Prices f. o. b. mill.

Supply Prices, March 5, 1926

ANODES

Copper: Cast	21⅞c. per lb.	**Nickel:** 90-92%	45c. per lb.
Rolled	21⅜c. per lb.	95-97%	47c. per lb.
Electrolytic	19 c. per lb.	99% plus	49c. per lb.
Brass: Cast	20⅞c. per lb.	**Silver:** Rolled silver anodes .999 fine are quoted from 70¼c. to 72¼c. per Troy ounce, depending npon quantity purchased.	
Rolled	21⅜c. per lb.		
Zinc: Cast	14¾c. per lb.		

FELT POLISHING WHEELS WHITE SPANISH

Diameter	Thickness	Under 100 lbs.	100 to 200 lbs.	Over 200 lbs.
10-12-14 & 16"	1" to 3"	$3.00/lb.	$2.75/lb.	$2.65/lb.
6-8 & over 16	1 to 3	3.10	2.85	2.75
6 to 24	Under ½	4.25	4.00	3.90
6 to 24	½ to 1	4.00	3.75	3.65
6 to 24	Over 3	3.40	3.15	3.05
4 up to 6	¼ to 3	4.85	4.85	4.85
4 up to 6	Over 3	5.25	5.25	5.25
Under 4	¼ to 3	5.45	5.45	5.45
Under 4	Over 3	5.85	5.85	5.85

Grey Mexican Wheel deduct 10c per lb. from White Spanish prices.

COTTON BUFFS

Full Disc Open buffs, per 100 sections.

12" 20 ply 64/68 Unbleached	$33.70–35.20
14" 20 ply 64/68 Unbleached	43.40–43.80
12" 20 ply 80/92 Unbleached	35.40
14" 20 ply 80/92 Unbleached	48.00
12" 20 ply 84/92 Unbleached	41.90–45.25
14" 20 ply 84/92 Unbleached	56.80–60.55
12" 20 ply 80/84 Unbleached	40.15–41.35
14" 20 ply 80/84 Unbleached	54.40–55.70

Sewed Pieced Buffs, per lb., bleached .70c.

CHEMICALS

These are manufacturers' quantity prices and based on **delivery** from New York City.

Acetone	lb.	.12–.16
Acid—Boric (Boracic) Crystals	lb.	.12
Hydrochloric (Muriatic) Tech., 20°, Carboys	lb.	.02
Hydrochloric, C. P., 20 deg., carboys	lb.	.06
Hydrofluoric, 30%, bbls	lb.	.08
Nitric, 36 deg., Carboys	lb.	.06
Nitric, 42 deg., carboys	lb.	.07
Sulphuric, 66 deg., Carboys	lb.	.02
Alcohol—Butyl	lb.	.19–.23½
Denatured in bbls	gal.	.40
Alum—Lump Barrels	lb.	.03¼
Powdered, Barrels	lb.	.042
Aluminum sulphate, commercial tech	lb.	.02⅜
Aluminum chloride solution in carboys	lb.	.06½
Ammonium—Sulphate, tech, bbls	lb.	.03¾
Sulphocyanide	lb.	.65
Arsenic, white, kegs	lb.	.08
Asphaltum	lb.	.35
Benzol, pure	gal.	.60
Borax Crystals (Sodium Biborate), bbls	lb.	.05½
Calcium Carbonate (Precipitated Chalk)	lb.	.04
Carbon Bisulphide, Drums	lb.	.06
Chrome Green, bbls	lb.	.30
Copper— Acetate (Verdegris)	lb.	.37
Carbonate, bbls	lb.	.17
Cyanide (100 lb. kegs)	lb.	.50
Sulphate, bbls	lb.	.05
Cream of Tartar Crystals (Potassium bitartrate)	lb.	.27
Crocus	lb.	.15
Dextrin	lb.	.05–.08
Emery Flour	lb.	.06
Flint, powdered	ton	$30.00
Fluor-spar (Calcic fluoride)	ton	$75.00
Fusel Oil	gal.	$4.45
Gold Chloride	oz.	$14.00
Gum—Sandarac	lb.	.26
Shellac	lb.	.59–.61
Iron, Sulphate (Copperas), bbl	lb.	.01½
Lead Acetate (Sugar of Lead)	lb.	.13
Yellow Oxide (Litharge)	lb.	.12½
Mercury Bichloride (Corrosive Sublimate)	lb.	$1.15
Nickel—Carbonate dry, bbls	lb.	.29
Chloride, bbls.	lb.	.19
Salts, single 300 lb. bbls	lb.	.10½
Salts, double 425 lb. bbls	lb.	.10
Paraffin	lb.	.05–.06
Phosphorus—Duty free, according to quantity		.35–.40
Potash, Caustic Electrolytic 88-92% fused, drums	lb.	.09¼
Potassium Bichromate, casks (crystals)	lb.	.08½
Carbonate, 88-92%, casks	lb.	.06¼
Cyanide, 165 lb. cases, 94-96%	lb.	.57½
Pumice, ground, bbls	lb.	.02½
Quartz, powdered	ton	$30.00
Rosin, bbls.	lb.	.04½
Rouge, nickel, 100 lb. lots	lb.	.25
Silver and Gold	lb.	.65
Sal Ammoniac (Ammonium Chloride) in casks	lb.	.08
Silver Chloride, dry	oz.	.86
Cyanide (Fluctuating Price)	oz.	.66
Nitrate, 100 ounce lots	oz.	.47
Soda Ash, 58%, bbls	lb.	.02½
Sodium—Cyanide, 96 to 98%, 100 lbs	lb.	.20
Hyposulphite, kegs	lb.	.04
Nitrate, tech., bbls	lb.	.04¾
Phosphate, tech., bbls	lb.	.03¾
Silicate (Water Glass), bbls	lb.	.02
Sulpho Cyanide	lb.	.45
Sulphur (Brimstone), bbls	lb.	.02
Tin Chloride, 100 lb. kegs	lb.	.43½
Tripoli, Powdered	lb.	.03
Wax—Bees, white ref. bleached	lb.	.60
Yellow, No. 1	lb.	.45
Whiting, Bolted	lb.	.02½–.06
Zinc, Carbonate, bbls	lb.	.11
Chloride, casks	lb.	.07⅛
Cyanide (100 lb. kegs)	lb.	.41
Sulphate, bbls.	lb.	.03¼